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"New Lamps for Old"

By F. W. Preston[1]

IT is recorded in song and story that Clementine, most famous daughter of the forty-niners, found her last job at blowing bubbles mighty fine. The Corning Glass Works has found its latest job in blowing bubbles even finer. Only, whereas Clementine's last job proved fatal, the Corning proposition is proving very healthy and profitable.

It is probable too that the old Arabian sneak thief that wanted Aladdin's lamp and went around the streets crying, "New Lamps for Old," would have been a great deal abashed if he had known that one day Corning would be turning out new lamps for old at the rate of four hundred thousand a day on one little machine, a cataract of lamp bulbs jostling each other in a wild stampede to lighten the world's darkness, all in a frantic hurry to be off and at work.

Corning Glass Works has taken a very prominent part in the development of lamp bulb blowing machinery. Its "E" machine, a semi-automatic marvering and blowing device, supplied by hand with punty and gather, and relieved of punty and bulb by hand, was the first machine to make bulbs of the modern type, and the Corning Bulb Machine is the latest. In point of time the machines are not so many years apart, but in production the "E" machine, now relegated to the making of blown chemical ware, turns out a few thousand articles per day, while the Corning machine runs within sight of the half-million mark.

The first bright idea of the new machine came to Mr. W. Woods, seemingly as a result of contemplating the Danner tube-drawing machine. The resemblance between the two machines is not great, but then an oak tree does not greatly resemble an acorn, and the fact remains that the primitive simplicity of the Danner machine did in fact contain the germ of that impressive plant that goes by the name of the Corning Bulb Machine.

The transformation is largely the work of David E. Gray,

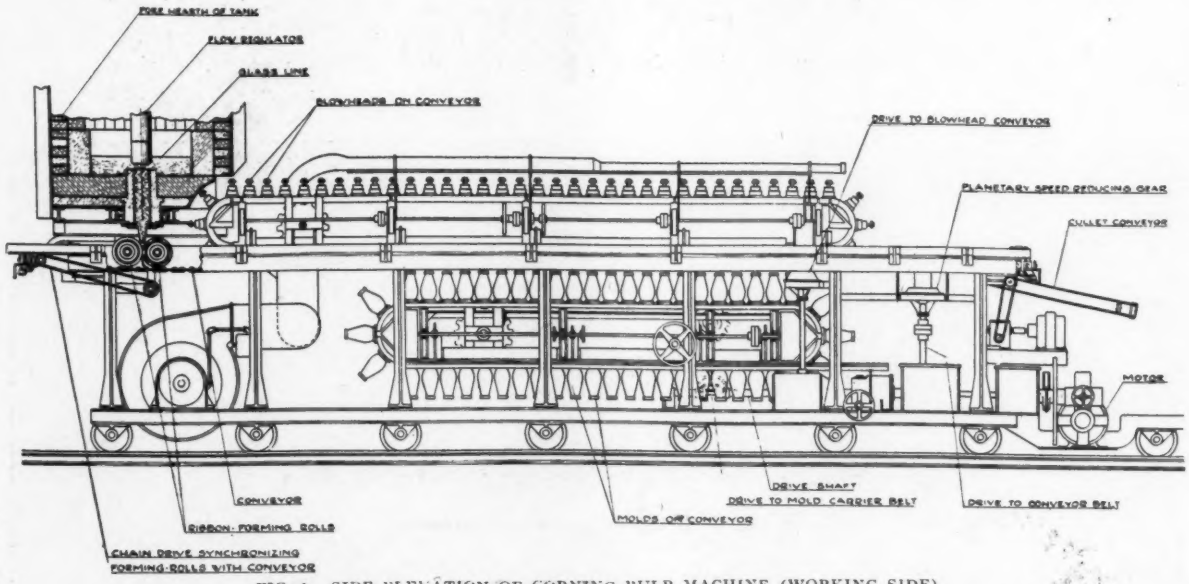

FIG. 1. SIDE ELEVATION OF CORNING BULB MACHINE (WORKING SIDE)

[1]Consulting Engineer, Butler, Pa.

chief engineer of Corning Glass Works, and a man of great inventive ability, like his father. The Corning machine is only one of a string of strangely varied inventions of his that range all the way from devices for sowing turnip seed to submarine signaling. We hope to give elsewhere a brief account of his activities, from which it will be seen that something was quite apt to happen when he, of all men, was presented with Mr. Woods' concept.

The machine has been described somewhat briefly, but well, by Prof. W. E. S. Turner (*J. Soc. Glass Tech*)., and with more illustrations by R. G. Skerrett in the *Compressed Air Magazine* (Oct., 1929). Neither of these descriptions, however, brings out the psychology of the machine, and the mental processes and concepts of which the machine is an embodiment, and neither of them makes any pretence of treating the matter from an engineering point of view.

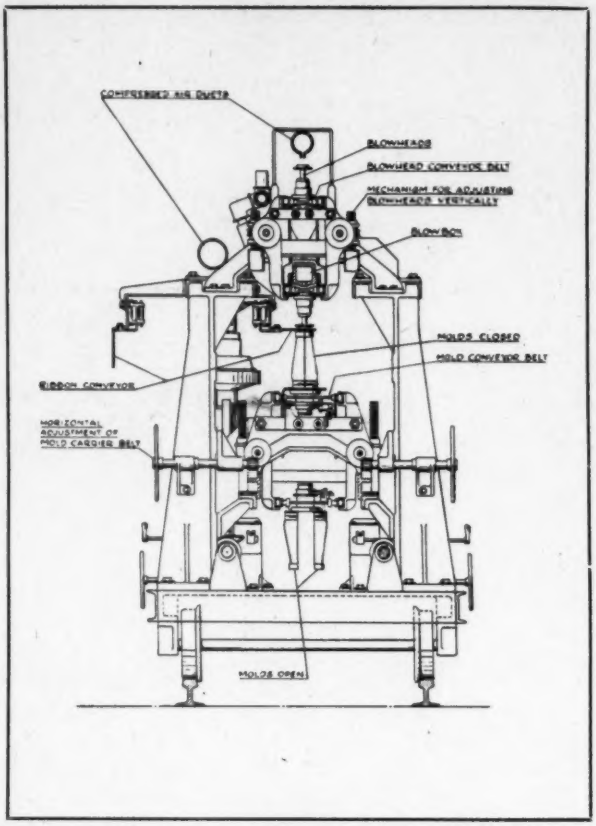

FIG. 2. CROSS-SECTION TAKEN THROUGH THE CENTER OF THE MACHINE ON A VERTICAL PLANE AND LOOKING TOWARDS THE TAIL-END OF THE MACHINE.

The Corning Bulb Machine is perhaps the third or fourth major illustration in the glass field of a seemingly vital engineering concept, a concept so vague and generalized as to be more like a metaphysical concept than an engineering principle. This idea is that for maximum results, the motion of machinery must be absolutely continuous, and the product should flow in a straight line, not in circles. It is easy to see in many particular instances, after these principles have been worked out, that they are correct, but it is not exactly capable of formal proof that the law is of universal application.

Perhaps the first machines in the glass field to demonstrate the idea were the continuous straight line sheet-drawing machines of Fourcault and Colburn, which have finally driven the intermittent cylinder machines, with their manifest advantages in some particulars, quite out of business. Another, scarcely less striking, was the development of the continuous rolling and continuous straight-line grinding and polishing of plate glass by Henry Ford's engineers, cutting costs nearly in half. Still another was the Danner continuous tube-drawing machine, and now we have the continuous bulb-blowing ma-

FIG. 3. TANK, SHOWING NECKS OF REGENERATORS AT MELTING END (LEFT), REFINING CHAMBER (RIGHT), PYROMETER CONTROL (RIGHT FOREGROUND), WITH THIRD CHAMBER OF TANK BEHIND, AND PART OF BASIN OR FLOW-CONTROL CHAMBER WITH ISSUING STREAM OF GLASS (EXTREME RIGHT).

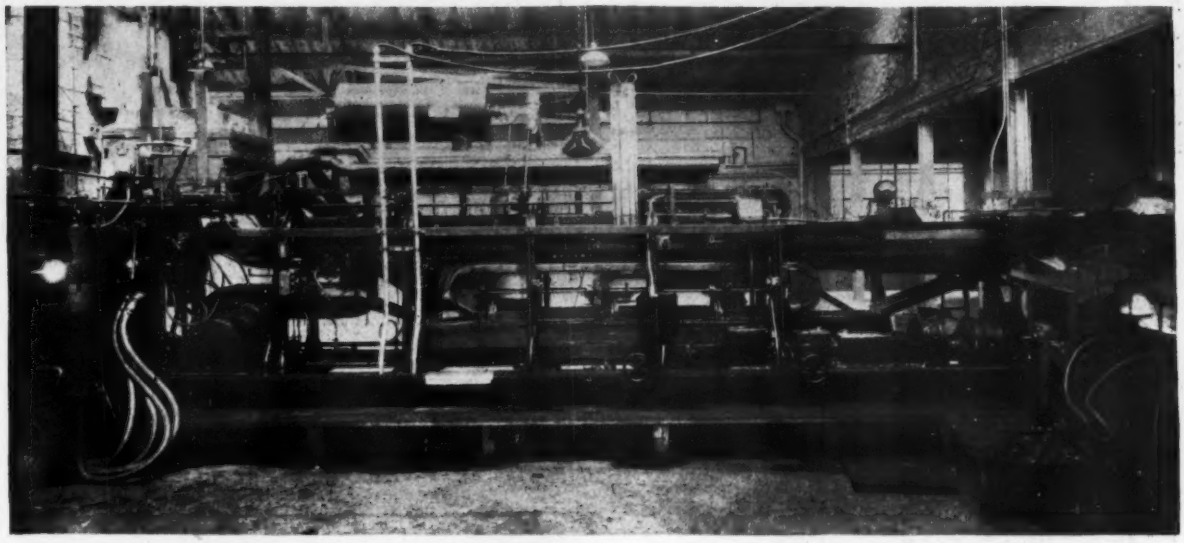

FIG. 4. A VERY GOOD VIEW, FROM THE CONTROL OR WORKING SIDE, OF THE WHOLE CORNING BULB MACHINE. THE MOVEMENT OF THE MACHINE IS SO RAPID OF COURSE, THAT THE INDIVIDUAL MOLDS AND BLOWHEADS ARE FUSED IN THE PICTURE INTO A CONTINUOUS STREAK.

ON THE LEFT SUSPENDED ON THE FRONT OF THE TANK IS THE SUPPLY BASIN WITH THE WHITE ISSUING STREAM OF GLASS.

ON THE EXTREME RIGHT AND AT RIGHT ANGLES TO THE MAIN MACHINE IS THE ANNEALING CONVEYOR. (SEE ALSO FIG. 13).

chine of Corning. It would seem that before long there will be little that is not straight-line continuous production in the American glass industry. Already efforts are being made to reduce, or exalt, the bottle-making business to this state.

The glass used is not very different from that used by Westlake machines. It is fairly high in alumina and the lime is dolomitic. The tank, however, is distinctly an advance, and in this matter some excellent work was done by the Simplex Engineering Company, who built a tank at Wellsboro, Pa., and a more ambitious one at Central Falls, R. I.

The later glass tanks, both at Wellsboro and at Central Falls, produce some 40 or 50 tons of glass per day.

The drawings, Fig. 1 and Fig. 2, specially prepared for THE GLASS INDUSTRY, represent simplified general assemblies of the machine. Fig. 1 is a side view of the machine from the working side, while Fig. 2 is a cross-section taken through the center of the machine on a vertical plane and looking towards the tail-end of the machine. By comparing these drawings with the photographs reproduced herewith, a very good idea may be had of the machine and its method of working.

From Fig. 1 it may be seen that the machine proper is

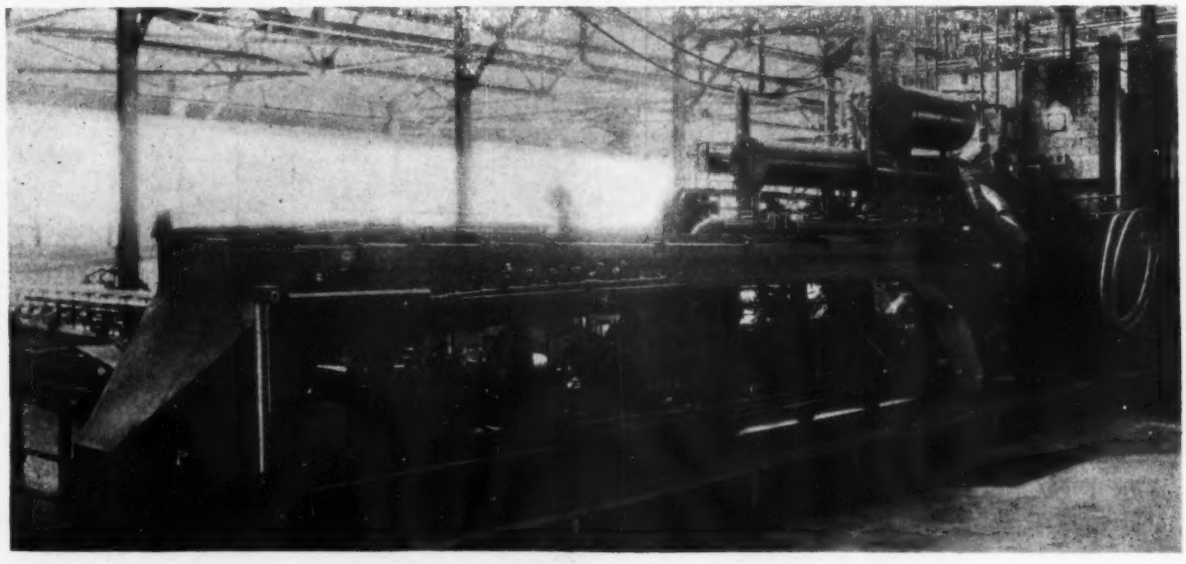

FIG. 5. REAR VIEW OF THE CORNING BULB MACHINE (OPPOSITE FROM WORKING SIDE).

mounted on a frame-on-wheels, which runs on rails permitting the machine to run up to, and partly under the forehearth of the tank at the left. Here it stays for some 48 or 72 hours, and it is then run away to the right to have the "paste" on the molds replenished while a second standby machine is run up to the tank.

FIG. 6. START OF COOLING BELT.

FIG. 7. GENERAL VIEW OF ANNEALING CONVEYOR. COOLING BELT, AT RIGHT ANGLE TO IT IN RIGHT BACKGROUND.

The construction of the forehearth or "bowl" is sufficiently indicated on the drawings: Its purpose is simply to provide a very steady stream of well-plained glass to the ribbon-forming rolls below. At the rolls the glass has a temperature of about 1050° C. (1920° F.). Of the two rolls, which of course are driven in synchronism, the left hand one, which forms the bottom of the ribbon, is a plain cylinder, while the right hand one has a number of circular recesses. The ribbon therefore emerges as a thin wafer of glass (⅛" thick) with "buttons" or discs of glass at 3.9" centers in a single row down the center of the ribbon. These "buttons," glowing red, Professor Turner says, remind him of poached eggs.

The ribbon descends only a few inches when it is caught and carried along upon a track or conveyor formed of a number of hinged steel plates, perforated with a hole in the center, and seen clearly on the extreme left of Fig. 1 and also indicated by the words "ribbon conveyor" in Fig. 2. The "buttons" or poached eggs come centrally over the apertures in the conveyor, adjustment of the machine permitting this to be done accurately. The buttons overlap the apertures all around, and their centers are without support of any kind. They therefore tend to sag slowly through the holes. This ribbon conveyor belt stays with the glass longer than any other part of the machine, and circulates in a horizontal path, the return track being on the far-side of the machine as seen in Fig. 1 and Fig. 4. In Fig. 1 the vertical drive shaft to the conveyor is indicated near the right hand end, and still farther to the right are seen some of the little plates, above the cullet conveyor, circulating around towards the rear.

The glass has not been on the ribbon conveyor more than a second or two when it runs under a second conveyor belt, the "blowhead conveyor," clearly shown in both Figs. 1 and 2. This conveyor circulates in a vertical plane. The lower track is the working track, and the upper is the return track. On this conveyor are a great number of individual blowheads, their mouths so arranged as to seat themselves

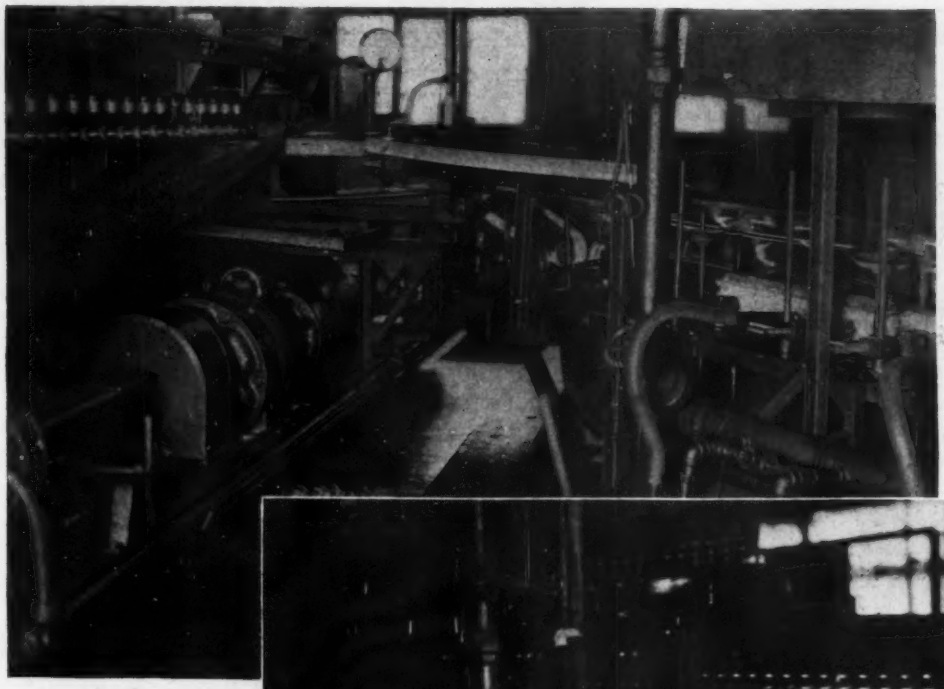

FIG. 8. STRIPPING AND CRACK-OFF END OF MACHINE AND START OF ANNEALING CONVEYOR.

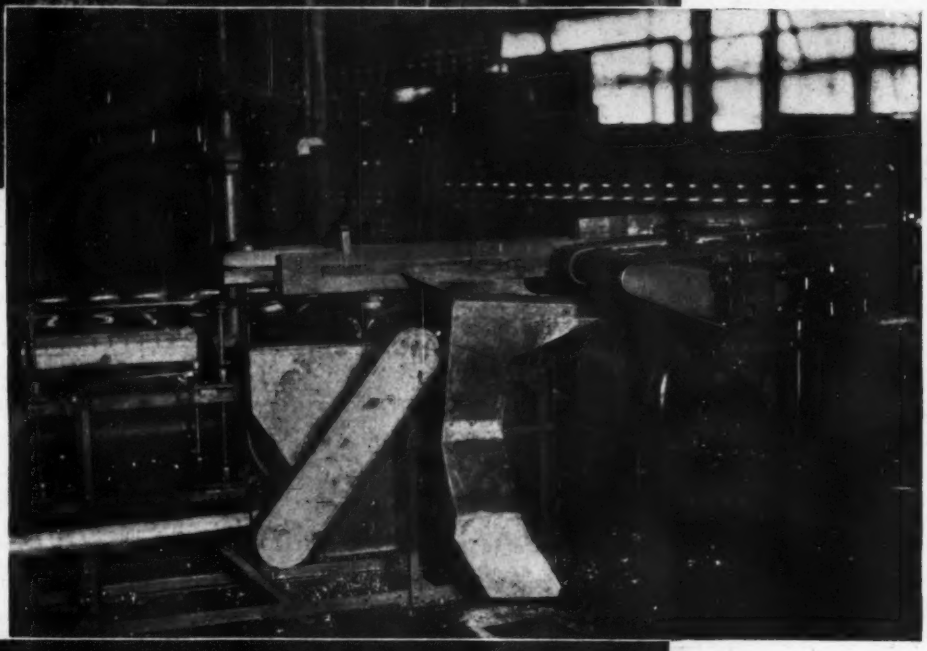

FIG. 9. FRONT PORTION OF ANNEALING CONVEYOR IN FOREGROUND. THE CORNING BULB MACHINE IS SEEN BEHIND. THIS IS THE SAME REGION AS FIG. 8, BUT FROM THE SIDE OF CONVEYOR. IT SHOWS THE INDIVIDUAL MOLDS ON THE BULB MACHINE BETTER THAN THE OTHER PICTURES.

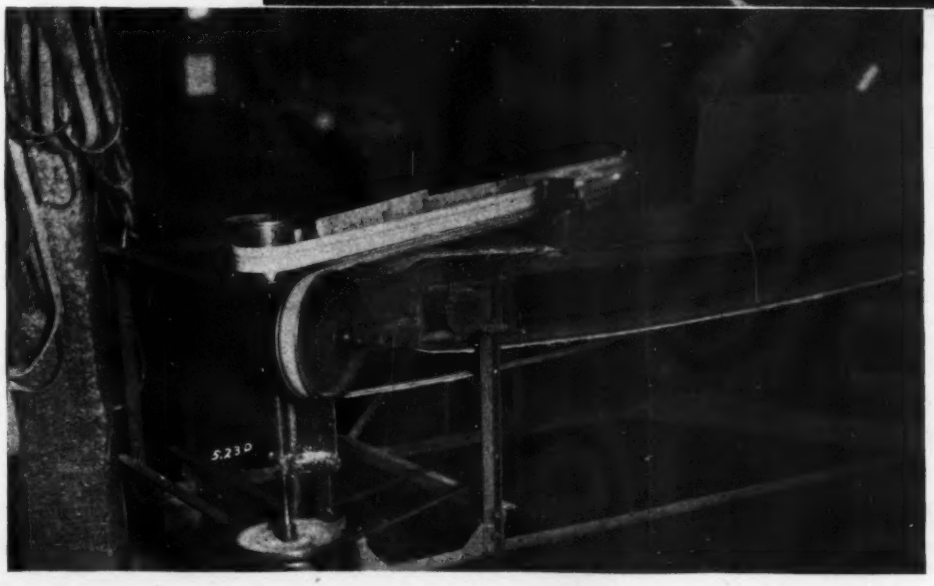

FIG. 10. A VIEW IN THE SAME CORNER SHOWN IN FIG. 11.

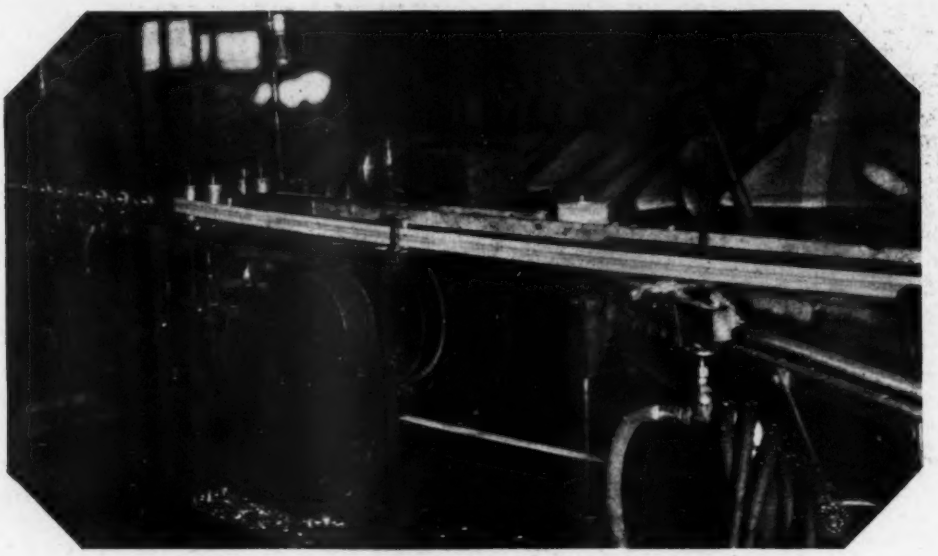

FIG. 11. END OF ANNEALING CONVEYOR AND START OF COOLING BELT.

on the centers of the poached eggs, while their opposite ends, really their bases, though in this position the base is uppermost, come into register with the blow box (Fig. 2).

This blowbox is a long narrow affair extending lengthwise down the machine between the working and return tracks of the blowhead conveyor. It is divided into sections by a cross partition. The first part has air at 19″ of water pressure, the second has less than 3″ pressure. Adjustments are provided on the machine to ensure that the blowheads registered accurately with the buttons of glass. Immediately they are seated, the 19″ pressure acts to blow the button through its hole, whereon it takes the form of a gradually elongating test-tube, red hot still, but in free air.

Up to this stage the glass of the button has touched solid material only for an instant, as it passed through the forming rolls. To be strictly scientific, an "instant" is about one-tenth of a second, a period barely discernible to the eye.

The red hot test-tube becomes several inches long and by this time it is hanging suspended between the two halves of a split blow-up mold which have appeared from below (Fig. 1 and 2). These molds are carried on a third conveyor, the "mold conveyor," the shortest of the three, but the most complicated and ingenious. Each link of this conveyor is a machine in itself, very compact, and comprising essentially a pair of racks mating with a gear wheel, one on each side of it. There is another gear or sprocket on the same shaft, and the latter mates with a rack device running longitudinally down the machine. This can be seen in Fig. 2. When the molds reach this rack, the mating wheel starts to rotate, and the first consequence of this is that the split mold closes in on the glass. When the mold is closed, further urging by the fixed rack causes the mold

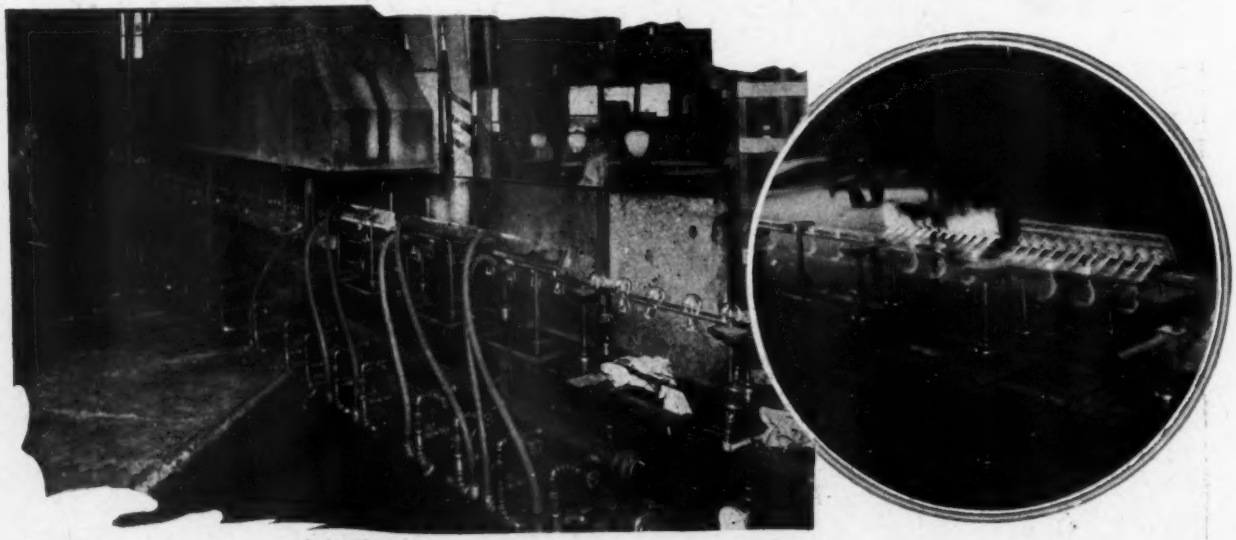

Illustration by courtesy of Compressed Air Magazine.

FIG. 12. LEFT—THE BATTERIES OF BURNERS USING COMPRESSED AIR AND BUTANE, THAT FUSE THE NECKS OF THE BULBS AS THEY COME FROM THE AUTOMATIC BLOWING MACHINE.

RIGHT—CLOSE-UP OF TWO GROUPS OF BURNERS SHOWING HOW THEY PLAY UPON THE BULBS PASSING CONTINUOUSLY BEFORE THEM ON THE CONVEYOR.

to spin on its axis. While this is going on the 3" air pressure blows up the test tubes to proper lamp bulb shape, the rotating mold preventing any mold-marks.

After a while the molds pass beyond the fixed rack, and encounter another on the opposite side of the machine. This would tend to spin the mold in the opposite direction, but the rack is short, and merely sufficient to open the mold, by opening the two internal racks first mentioned, and the open molds then depart downward towards their return track. At about the same time the blowheads withdraw from the upper side and retreat upward to their return track.

The glass bulb, now completely formed, is once more in free air, and connected to nothing but the ribbon conveyor. This conveyor goes on for a foot or two and passes by a flap of metal, which is really a hammer. This flap is oscillating in synchronism with the arrival of the bulbs. It gives each a nonchalant crack on the side, and the bulb obligingly parts from the ribbon of glass and from the ribbon conveyor, at the point where the blowhead was seated. It drops upon a belt which carries it at right angles to its former direction for a foot or two and drops it into the strain-removing machine. In the meantime the ribbon of glass, continuing straight ahead, slides into the cullet conveyor (Fig. 1) and is soon back in the tank, while the ribbon conveyor slides adroitly from under it and moves to the far side of the machine to its return path.

Strictly speaking we have now reached the end of the Corning Bulb Machine, but we may with advantage follow the bulb for a few seconds more.

From the belt where we last left it, it falls, neck first between two narrow steel ribbons set on edge. These are sufficiently well seen in Figs. 8, 9 and 11. The neck passes between the two ribbons while the bulb is too large to pass. Both ribbons travel rapidly away from the bulb machine, but one goes faster than the other, and the bulb accordingly rotates. Fires play upon the neck at the crack-off, removing the strain introduced by the chill of the blowhead and conveyor belts, and warming up the neck generally. After about eight seconds of this treatment the steel belts drop the bulbs upon a slowly travelling belt, where they are reduced nearly to room temperature, and at the end whereof they come once more into open air for examination, frosting and packing.

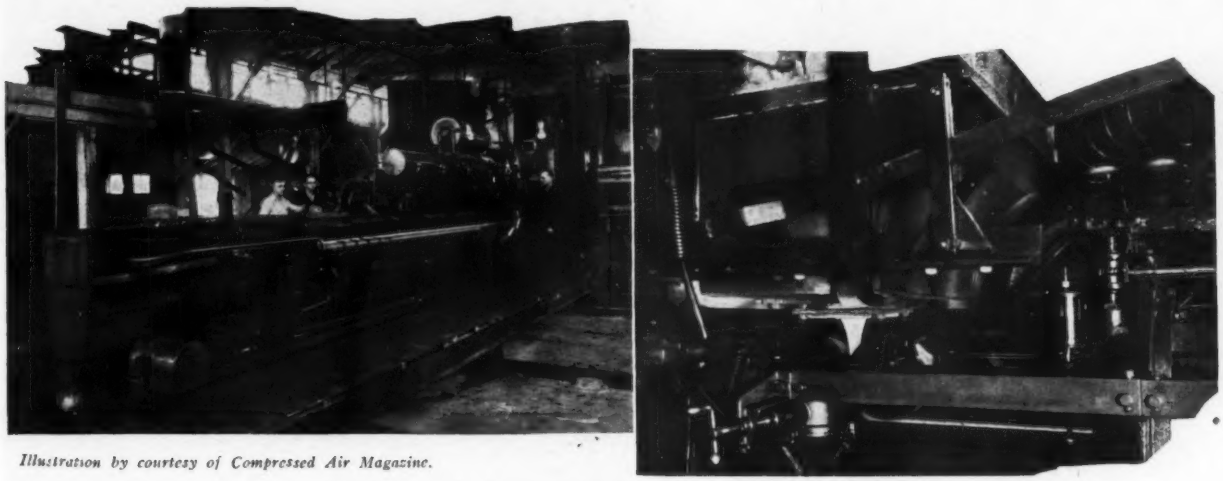

Illustration by courtesy of Compressed Air Magazine.

FIG. 13. LEFT—ONE OF THE BULB-BLOWING MACHINES IN THE WELLSBORO PLANT OF THE CORNING GLASS WORKS. THIS MACHINE IS CAPABLE OF MAKING AS MANY AS 300 BULBS A MINUTE.

RIGHT—CLOSE-UP OF THE FEEDING END OF A BULB-BLOWING MACHINE SHOWING THE MOLTEN GLASS FLOWING FROM THE FURNACE AND PASSING BETWEEN THE ROLLS WHICH FLATTEN IT INTO A RIBBON FROM WHICH THE BULBS ARE AUTOMATICALLY BLOWN AS THEY PASS ALONG ON A CONVEYOR.

There are in the country at the time of writing, two tanks equipped with Corning machines at the Wellsboro, Pennsylvania, plant of Corning Glass Works, and one such tank at Central Falls, Rhode Island.

The machine must be almost unique in its ingenious arrangement of co-operating conveyors; the conveyors themselves are not simple tracks or chains, but ingenious, and, in a sense somewhat intricate pieces of mechanism. A feature of the machine is an extensive use of differential gearboxes, by means of which it is possible to adjust each conveyor into exact synchronism and phase relation with the others and with the "buttons" on the strip of glass.

One of the big difficulties in most conveyor systems, when anything intricate is attempted, is the tendency of the conveyors to stretch. In addition there is generally a jerky movement. Anything of the sort would be fatal in a machine having so many co-operating conveyors as the Corning machine and Mr. Gray has met, and solved (we think for the first time) some very interesting and important engineering problems in this connection.

By the courtesy of Corning Glass Works we are able to reproduce herewith a larger and better series of photographs than have hitherto been released, and we think that these, with their captions, taken in conjunction with the drawings (Figs. 1 and 2) will give a better idea of the machine than a great deal of text.

The Manufacture of Rolled Plate

By ERNST LUTZ *

(Continued from the July, 1931, issue)

This work has been revised, so far as the English and the technical expressions are concerned, by F. W. Preston, who has also added a number of notes relating in general to the special conditions of American practice; but it must be understood that the opinions expressed in the text are those of Mr. Lutz, and neither the Editor nor Dr. Preston accepts responsibility for them.

THE glass of better choice, if its polishing is not perfect, must be finished in the room B. For shop windows and for smaller sheets intended for glazing purposes a less perfect polish is sufficient; it therefore depends on the relative output of the polishing and grinding machines, how far the polishing of the whole output of plate glass sheets should be carried, since some or all sheets of better quality can be repolished for a larger or shorter period on small machines in the room B. The policy should be that all sheets obtain in the first instance such a polish that they meet throughout the severest requirements.

The sheets which, right in the plant, will be bevelled or used for mirrors, are conveyed to the beveling shop C, the silvering shop D and the varnishing shop E. The silvering and varnishing shops must be dust-tight on the side towards the packing room S; these two shops therefore are best approached through the beveling shop C.

Next to the packing shop is the box-maker's shop F which must be sufficiently large to accommodate a certain stock of finished cases. G indicates the store for box lumber; the other packing materials like hay, excelsior and the like, on account of the danger of fire, are kept in a separate shed H. I is the general store for the whole factory; near to it the rouge-preparing room k is situated. The repair shop L contains also the carpenter's shop, the forge, the blacksmith's shop, the electrician's shop and the like; M indicates a courtyard, which is to some extent in reach of the crane N of about 20 tons capacity, this latter is operated either by hand or electrically. The part of this courtyard in reach of the crane N can be used for storing reserve parts which are not damaged by lying in the open air. The end of the repair shop L facing the courtyard contains an opening closed by a trap door through which the travelling crane N enters the shop. In a similar way, but in the opposite direction, this crane can move 30-70 feet into the grinding shop; heavy repair parts from the said courtyard can thus be brought either into the workshop or into the grinding hall; in the latter they can, if required, be put on a grinding table and so moved further into the shop by the aid of the transfer table g. O indicates a frame on which the grinding runners of the grinding apparatus are suspended in order to change the worn runner bars; for this purpose the heavy runners are lowered in the grinding machine on to a grinding table, then disconnected from the grinding machine and finally conveyed with the traverse table g under the frame O.

P shows the open grinding-sand store, over which the elec-

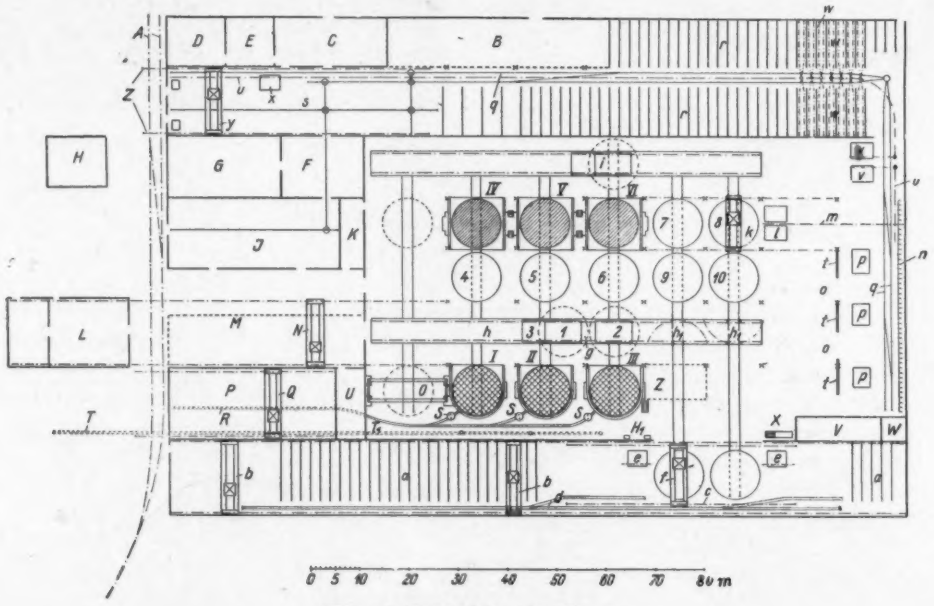

FIG. 125 (*Repeated from July Issue*)

* Of Desseau, Germany. This work is appearing in German in the new edition of *Dralle-Keppeler*, "Die Glasfabrikation."

FOOTNOTE: In the Figures, originally prepared for use eventually in the new edition in the German language of *Dralle-Keppeler*, "Die Glasfabrikation" in 1931, dimensions are given in metres (*m*) and millimetres (*mms*). We would like to have given these in feet and inches but the translation and the making of nearly two hundred and fifty new illustrations would have involved a prohibitive loss of time and expense. To some of our readers the metric system is as familiar as the English units; for the others we may say that a metre is approximately 40 inches, and a millimetre is approximately 1/25 of an inch. A thousand millimetres, of course, go to a metre.—*F. W. P.*

trically driven travelling crane Q operates and moves out to the railroad tracks A. The open sand gondolas are emptied with the aid of a clam-shell suspended from the crane. In place of Q a single rail trolley with clam-shell can be used which not only travels over the sand store, but also over the grinding machines where it drops the sand into bunkers, from which it runs directly to the grinding tables with the aid of a water jet.

R indicates a gutter running below the sand store, and down to this the bottom of the latter slopes on either side; nozzles shoot jets of water on to the inclined bottom of the sand store, so that sand mixed with water runs through the gutter R to the pits S, which have a depth of 20 to 40 feet. The flow of the gutter R to the pits S is regulated by valves. The pulverized crushed sand, i.e., the used sand returning from the grinding machines also flows to these pits, onto the bottom of which compressed air of about 20-35 lbs. per square inch effective pressure is blown. The mixture thus produced, consisting of sand, silt, water and air, is brought to the sand grading equipment by the air-lift action through a tube reaching nearly to the pit bottom. From the graders it is fed to the grinding table. The surplus silt and water flows through a channel T into the setting pond, where the silt settles and the clear water is pumped back to the shop. In place of the pits S and the compressed air centrifugal pumps are sometimes used for lifting the sand and silt; the casing of these pumps is protected with an easily removable cast iron liner against rapid wear.

U indicates the room where the pulverized emery is stored and prepared for fine grinding. The apparatus for preparing sand and silt, instead of being arranged individually over each grinding machine, can also be erected in this room U and be connected with special channels to the various machines. The main stock of plaster for the setting of the rough glass sheets on the grinding tables is kept in the general store, where it must be kept absolutely dry; in the neighborhood of the laying berths the room V must be provided with stock for a few days only. W is a small room for storing miscellaneous cleaning materials. X indicates an electrically operated winch for removing empty grinding tables from the places 7, 8, 9 or 10 to the laying shop C in case the transfer table g is otherwise engaged. For this purpose the hauling rope is guided by pulleys anchored in the floor, and the recess h is bridged over by movable rails h_1. At h_1 are situated a washing and wringing-machine for the cleaning of flannel cloths contaminated with plaster.

The distance of the grinding table tracks from each other as well as that of the transfer table from the grinding and polishing machines and from the building walls and pillars has to be ample to ensure that, when removing the table, men cannot be trapped; for the placing of the grinding tables at 4, 5 and 6 special marks must be provided to make sure that these tables stand sufficiently clear of the transfer table g, that the passing by of other tables does not involve any danger. It must be borne in mind, that the protruding of edges of glass sheets beyond the table cannot altogether be avoided.

For the complete equipping of a grinding shop containing 3 grinding machines and 3 fast working polishing machines at least 13, and preferably 14, grinding decks are required and a 15th as stand-by. The foremen's and superintendent's stands can be arranged at Z about 7 to 9 feet over the floor level so that the whole grinding and polishing shop can be viewed and the tables standing on the second laying track pass under it.

Fig. 126 gives a view of such a grinding and polishing shop. In the foreground a number of grinding tables are seen with a vacuum crane passing over them. At the right hand side a traverse table may be observed. In the back-

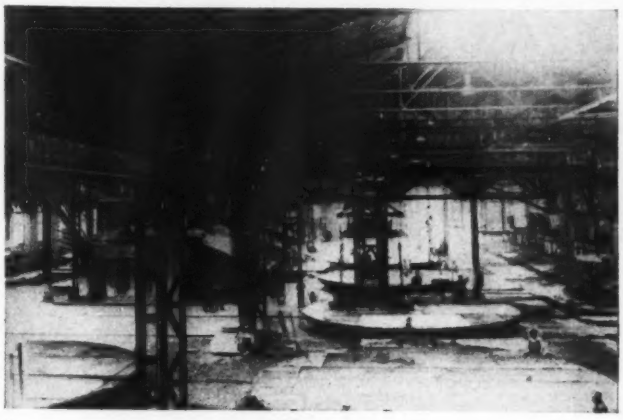

FIG. 126

ground and on the right side stand the grinding machines; at the left hand side the polishing machines, and behind them a second transfer table, are visible.

GRINDING APPARATUS WITH CIRCULAR TABLES

The machines for grinding and polishing rolled plates that have until recently been used almost exclusively (and at the present time are still being used in many cases) are

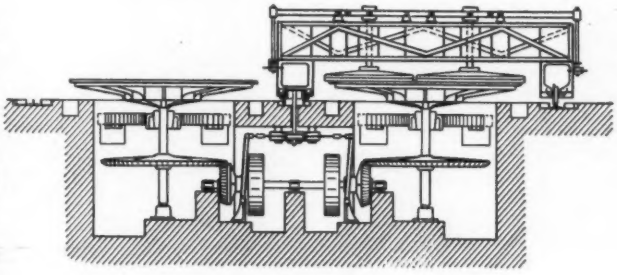

FIG. 127

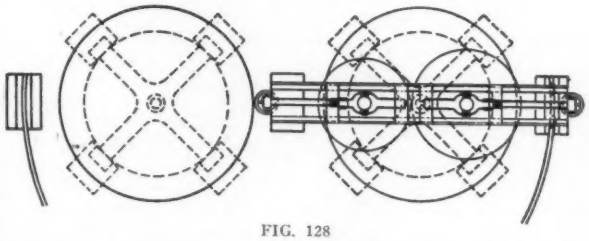

FIG. 128

characterized by the fact that the grinding and polishing decks, on which the sheets are set, are removable, and are inserted in stationary grinding and polishing apparatus. Even towards the end of the last century tables were very often rigidly built into the machines and the

bridges together with the grinding and polishing runners were removable. Figs. 127 and 128 show an arrangement with two tables rigidly fixed on their shafts; the bridge together with the grinding runners turns round a pivot, so that it can be brought in turn over the two tables, its free end running on a circular rail. Instead of swinging the bridge round a pivot, it was in other cases moved on two parallel rails. While sheets were being worked on one table, the other one was relaid. In a larger factory, with a number of such machines, the sheets had evidently to be conveyed to a number of places for laying, while today they go to one central laying department.

As the stripping and laying of the sheets takes appreciably less time than the grinding and polishing, the table was, in the bridge system, left idle for quite a while; with an equal number of machines, for this reason alone, the output of a grinding and polishing factory with removable tables is higher. Moreover a grinding and polishing bridge which is not stationary will never be absolutely rigid during the process of grinding and polishing; in contrast with the present-day truss-work, it will sway and spring perceptibly, thus reducing the grinding and polishing output. Again, for the polishing process, the grinding runners have to be replaced by polishing blocks, which is a slow operation. Further, if the grinding and polishing takes place in one and the same machine the danger exists that during polishing sand grains may fall on the table and spoil the glass surface; even with the greatest precautions it can happen that, after the grinding, parts of the machine situated above the table still harbor some sand grain which may afterwards drop. For this reason, in spite of loss of time and further drawbacks, it was originally preferred, to strip the sheets from the stationary table after the fine grinding and to lay them anew on a separate polishing machine.

CONTINUOUSLY WORKING GRINDING AND POLISHING APPARATUS

Recently for the grinding, fine grinding and polishing of smaller sheets, continuous machines have come into use; in these, the tables set with sheets move in a continuous sequence on straight rails or other guides beneath the grinding and polishing discs. As mentioned above, there are already some continuous layouts in operation that are able to grind and polish sheets of the largest dimensions.

The development and introduction of these so-called continuous grinding and polishing lines is to be credited especially to the Ford Motor Company and the Pittsburgh Plate Glass Company in the United States and in Europe to the firm of Pilkington Brothers, Limited, in St. Helens, England.

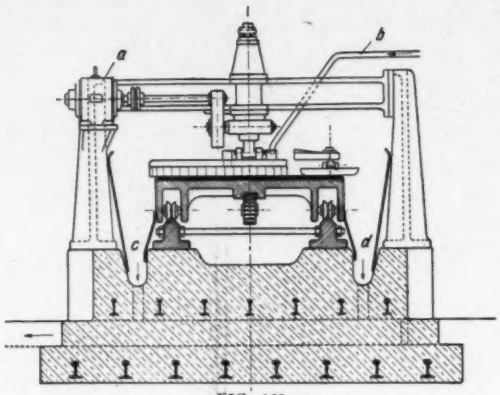

FIG. 129

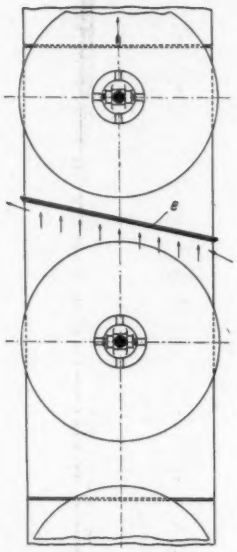

FIG. 130

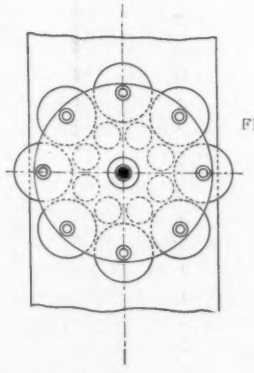
FIG. 131

Figs. 129 to 131 show a design of this type as used in the United States of America and first introduced by the Ford Motor Company for grinding and polishing windshields and car windows in their River Rouge works near Detroit. The table consists of two carriages of 9 ft. 5 in. length and about 42 in. width, coupled to each other. The whole continuous grinding and polishing line consists of two tracks running parallel some 7 to 9 feet apart. The glass cut to sheets at the exit from the left is laid in plaster at the start of the one track upon rectangular tables which are lined up on the grinding track and carried along automatically. On this first track, the first side of the sheet is ground and polished. At the finishing end of the track, the plates are cleaned and the tables stripped. A transfer device moves the tables in succession to the second track where they travel in the opposite direction. At the starting end of this second track the plates are turned over and again laid on the tables with the finished side down. On this second track, the second side of the plate is ground and polished. At the end, the plates finished on both sides, are taken off, cleaned, and inspected. The empty tables are transferred

again one by one to the first track and reset with new glass.

Above each of the tracks hang 43 grinding heads and 36 polishing heads.

The Mississippi Glass Company of St. Louis in their St. Louis Works have a similar machine of about 11½ ft. length and 60 in. width for the grinding and polishing of wire glass sheets. Both were built by the Hooven, Owens & Rentschler Company of Hamilton, Ohio. The carriages in the case of the River Rouge works move with a speed of about 35 in. per minute and those of St. Louis of about 29 in. per minute.

The grinding and polishing heads are individually driven by electric motors with a gear and a worm drive. The runners for the grinding and smoothing are of cast iron with cast-on runner bars (see Fig. 129 at the left hand side and Fig. 130). Sand and emery are fed at *b* through recesses of the discs and near their axis; when used up, this abrasive material flies out from the table and is caught in the gutters *c* and *d*. In between the various grades of sand and emery, wooden boards *e* are put on the table; at their bottom edge they are fitted with a rubber strip, which presses on to the glass surface and thus cleans it. To prevent sharper grains from reaching the next finer stage, washing water is sprayed in front of the boards.

The polishing discs are similarly constructed and driven; on their lower side they carry a ring of about 6 to 10 polishing blocks faced with felt (see Fig. 129 at the right hand side and Fig. 131). In machines for polishing a wider ribbon of glass, the distribution of the polishing blocks is so arranged that a second ring is provided, as indicated for instance in Fig. 131 in dotted lines. The rouge is put on automatically. Every thirtieth to fortieth second a small spot falls aside of each of the polishing blocks. The spot is then picked up by the felts as the advancing glass comes within reach of the felts.

Today adequate experience is available relative to the most favorable speed of the grinding, smoothing and polishing heads, on their most suitable number, on the power requirements, and the pressure to be used with the grinding discs.

The electric motors for the driving of the grinding and polishing heads are of about 9 H.P. each at River Rouge, while the larger heads in St. Louis need motors of about 12 H.P. each. Alternate grinding heads turn in opposite directions. The polishing heads run all in the same direction. While the grinding heads make about 20, the smoothing and polishing heads make 35 to 50 revolutions per minute.

The new process has developed to a point where even with considerable table width, a good polish is attained.

In this connection reference may be made to the issue No. 1 (January, 1923), and No. 7 (July, 1924), of THE GLASS INDUSTRY of New York, in which machinery of the Ford Motor Company in the Highland Park and River Rouge plants is described and to some extent illustrated.

In the American Patent Specification 1,375,129 of April 19, 1925, a device as shown in Figs. 132 and 133 is illustrated.

The cross girder 27 and the two grinding and polishing heads 1 rotate along with shaft 28 and the gear wheels 34 are rigidly keyed to the same shafts as the heads. The gear wheel 31 surrounding the shaft 28 is fixed to the main support 3, and does not rotate. In between the fixed gear 31 and the two gear wheels 34 the wheels 32 run as idlers. With the aid of this planet gear, apart from their movement round the shaft 28, the two discs get an additional movement around their own axis. This combined movement aims at a working of the glass surface, which is more uniformly distributed over its width.

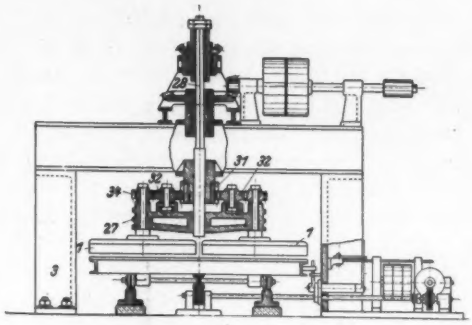

FIG. 132

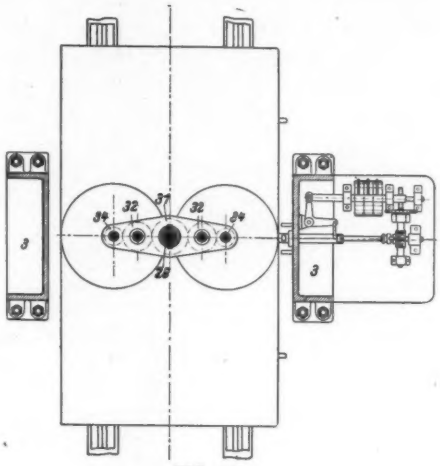

FIG. 133

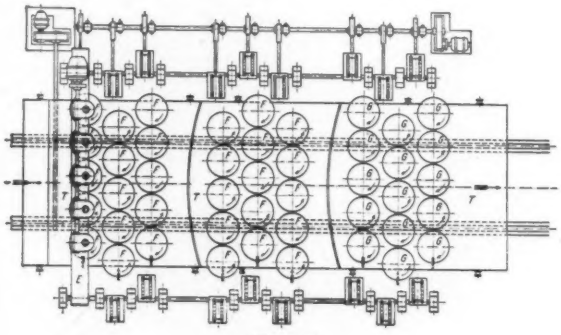
FIG. 134

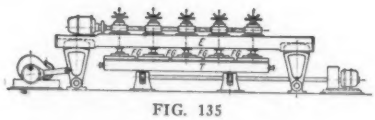
FIG. 135

The German patent specification No. 375,925 of September 12, 1921, describes a similar plant of Messrs. Heuze, Malevez & Simon Réunis S. A. at St. Servais, Belgium (see Figs. 134 and 135). The tables T according to the specification are moved continuously in the direction of the arrow. The grinding and polishing discs are suspended on oscillating beams E; each beam carries an electric motor driving its discs. As shown by the various arrows in Fig. 134 the movements of the different beams do not synchronize, but are so arranged that whilst one beam swings to the left, the next is swinging to the right. According to the specification the grinding and polishing discs are either all moved in the same direction or alternately so that the one moves clockwise and the other counter-clockwise. The intention is that the first group of grinding discs F serves for rough grinding, the second group F for smoothing and the third group fitted with polishing discs G for polishing.

Instead of having the rectangular tables run on two tracks on the same level and running in opposite directions, there have also been constructed layouts with a single grinding and polishing line built above the floor. The empty tables are returned below this operating line to its starting end. This system has been developed more especially by Pilkington Brothers, Limited, in England. The has joined the series last and pushes forward the entire series of tables ahead of it.

The pressure and friction of the tables against each other and the weight of the grinding and polishing heads may be used to prevent the tables shifting against each other vertically, and so breaking sheets of glass that are laid across joints between the tables. Tables fitted together with tongue and groove tenon provide still more safety.

Figures 135 A and 135 B, obtained by courtesy of Herr L. von Reis, show details of a grinding and polishing line where the tables are returned below the working level. Fig. 135 A shows a longitudinal section with the last two grinding machines at the left and the first two polishing machines at the right. Fig. 135 B shows a transverse section through the track with a view of one grinding machine. a, a are the tables covered with the glass to be surfaced and traveling in the working line, and fitting together with groove and tongue molding, thus forming one rigid sequence. b, b are the runways on which the tables slide. Below the operating line, in the cellar, is a roller conveyor on which the empty tables are returned to the starting end of the operating line. The motor c drives the tables a on the runway b, b by a rack fixed to their undersides. The roll conveyor below the floor is also mechanically driven through the transmission d, d. Motors e transmit to the grinding

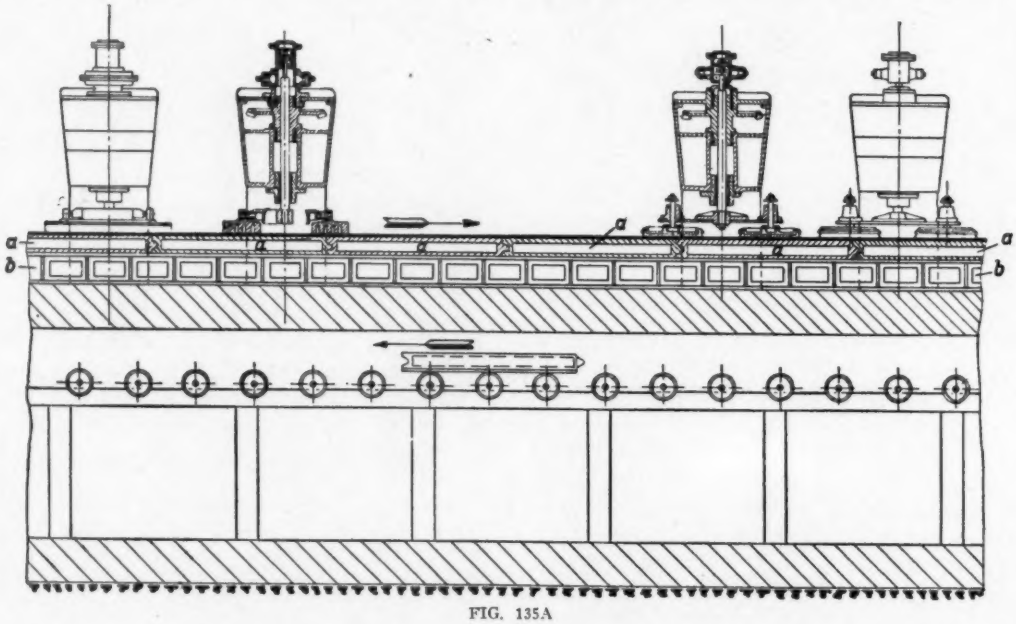

FIG. 135A

American patent 1,693,534, of Frederic Barnes Waldron, assignor to Pilkington Brothers, Limited, describes apparatus by which the tables are lowered at the finishing end of the operating track and returned to its starting end below its level. At the starting end, the tables are lifted to the level at which the work is executed and connected anew with the driving gear of the apparatus. According to the German patent 400,169 of Pilkington Brothers, Limited, the tables which touch each other are to be pushed forward by a table that has not yet reached the grinding heads; in other words, the drive comes directly on the table that and polishing frames by means of the eccentrics f and levers g, g the sideways motion to and fro as proposed in the above mentioned Heuze patent (Fig. 135).

The first plant of this type in Europe was erected by the Herzogenrather Glaswerke Bicheroux & Cie., G. m. b. H. which possesses in Herzogenrath near Aachen a continuous grinding and polishing machine of about 230 feet working length and about 10 feet table width (see *Glastechnische Berichte*, 4. Jahrgang, February, 1927, Heft 11, Pages 417-419, paper of Dr. Ing. K. H. Schmidt on "Fliessarbeit in der Glasindustrie"). Ac-

cording to this information the rough glass at the beginning of its run is set in plaster on the tables and then sent through the grinding machines. The first machines effect the rough grinding, the next following the smoothing. After the smoothing the ribbon of glass runs through an inspection room where the glass surface is cleaned, the grinding inspected and the joints between the sheets prepared for the polishing. The plant is equipped with 8 grinding and 13 polishing heads.* (See also *Zeitschrift des Vereins Deutscher Ingenieure,* No. 26, June 28, 1930, v. Reis: "Neuzeitliche Spiegelglasherstellung.")

"A second fundamental defect in grinding on circular tables lay in the fact that it was not a continuous process, thus causing complicated and costly transfer systems and much waste of space (Fig. 125). Under the influence of the catchword of straight line production that triumphed especially in North America, they came to trying to adopt this principle for the process of finishing rough glass. This resolve was reached in three places simultaneously. The Ford Motor Company wanted to secure glass for the windshields of its automobile production which had grown to gigantic dimensions, for under the influence of the rapidly

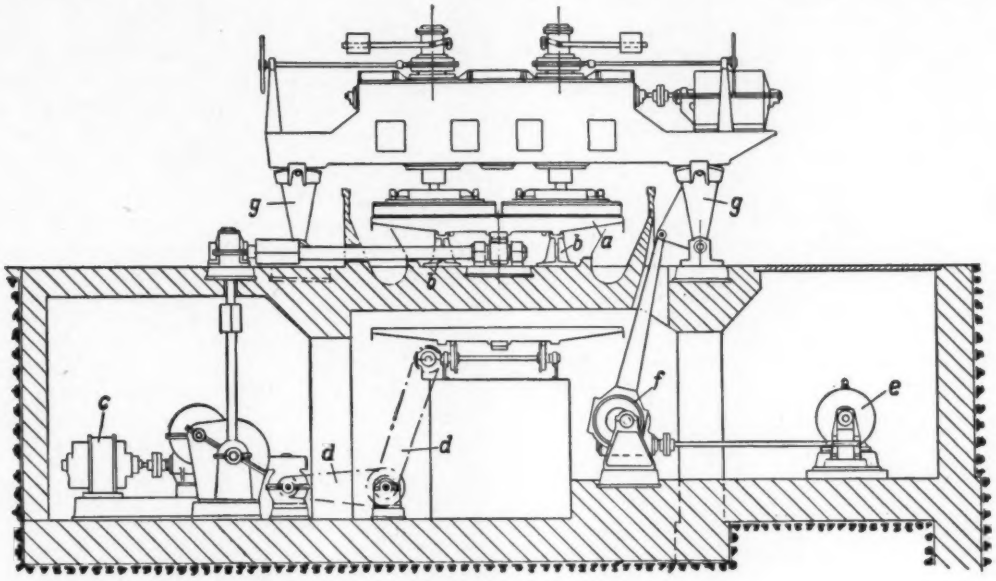

FIG. 135B

The following interesting comments are taken from a special report by Herr L. von Reis, Herzogenrath:

"The grinding and polishing of rolled plate glass on circular grinding and polishing apparatus had reached a great technical perfection which, however, could not overcome certain fundamental deficiencies of principle. One of these fundamental defects was simply the use of circular grinding tables. Although they permit good and uniform grinding and polishing, there is one great disadvantage: rolled plate glass is manufactured only in rectangular plates. To fill out the circular form of the tables one needs besides the useful large rectangular sheet a certain amount of small, i.e., and unprofitable undesired sheets, and even small three-cornered pieces of cullet. A large part of these small pieces cannot be sold except below cost, if at all. Therefore, it was desirable to replace the circular table with a rectangular one in order not to be forced to carry a dead weight of small glasses that cannot be sold.

"A rectangular table avoids this difficulty. Originally men had started with rectangular tables, but as these were used for circular grinding, they were a still greater handicap because the corners of the glass plates could be worked but poorly. They therefore proceeded to omit the corners and preferred the smaller evil of circular tables.

* Much less than American Practice.—F. W. P.

increasing demand, the price of polished plate had risen four times within a short period. The second pioneer of the new system was the firm of Pilkington Brothers, Limited, in St. Helens, the old English company owning a monopoly of polished plate glass in Great Britain. Furthermore, the grinding and polishing line was developed by the Pittsburgh Plate Glass Company, whose earliest patents on this subject had been filed as far back as 1903.

(To Be Continued)

Nitrates in the Southwest Not Valuable Commercially

The Department of the Interior announced this Spring that the United States Geological Survey had just published a report on nitrate deposits in the Southwest, chiefly in California. The present Bulletin No. 820, written by L. F. Noble, describes fourteen localities in Southern California, two in Nevada and one each in Arizona and New Mexico. The Nevada localities and most of those in California were reported as practically valueless commercially. Three of the California localities, so-called "dry-lakes," vielded no nitrate, the others only bare traces.

Standard Samples issued by the Bureau of Standards. (Supplement to Circular No. 25, dated January 15, 1931.) Sample standards of materials of various kinds as furnished to those requiring them by the Bureau of Standards are listed. Included are the following items: glass sand, glass, soda lime glasses, and lead barium, opal, low boron, high boron glasses. With the exception of the glass sand and the low boron glass, which is analyzed for B_2O_3, complete analyses are furnished at a price of $2.00 per sample.

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Reference to the contents of earlier issues of THE GLASS INDUSTRY can be found in THE INDUSTRIAL ARTS INDEX in many Public and Technical Libraries.

A Single Court for Patent Appeals

SOME years ago the patent committee of the American Bar Association recommended that a single court of appeals be established for jurisdiction over all patent appeals. Several unsuccessful attempts have been made to introduce a bill in the House of Representatives providing for such a court. At the present time, advocates for this single court are making another effort for recognition in the House, and it is to be hoped that this time they will succeed.

In a powerful editorial on the subject, *Industrial and Engineering Chemistry,* states:

> "There can be little doubt that the present system of patent appeals in the United States is the most inefficient, expensive, and wasteful to be found anywhere. Such suits deter production of inventions, as well as the investment of capital in the development of patents. Our country is now divided into ten circuits, each of which has a circuit court of appeals with final jurisdiction over all patent appeals in its circuit. These courts are independent. They are at liberty to decide differently on the same set of evidence and precedents and they frequently do. The fact that a patent is successfully defended in one circuit by no means insures that it will be upheld in all circuits. And the original infringer may stand suit in another circuit, requiring the owner of a patent again to go through a long trial involving expensive attorneys' fees, scientific experts, and all that goes with the modern patent trial. It is not always easy to appeal from these circuit courts of appeal, for the Supreme Court, with its great volume of work, does not take up a patent case unless some question of public importance or an interpretation of law is involved."

To many of those concerned with glass, the foregoing is an old story, and further argument would be superfluous. Anyone who has ever been interested in a patent suit concerned with automatic glass-making machinery knows well the involved character of the technical and scientific problems that arise, and how few judges are properly qualified to pass upon them. With a single court of appeals a decision would be applicable to the whole country instead of to a single district. Properly qualified judges with the necessary technical and mechanical training could be appointed. Much time and money would be saved, and the volume of patent litigation reduced.

When the new bill is introduced, it should have the active support of everyone concerned with the technical phases of the glass industry.—*D. E. S.*

Looking Backwards

By W. H. S. CHANCE

MANY discoveries in the past, which at the time appeared to have no practical value, might have been put to useful purpose had other branches of knowledge shown an outlet for the fruit of the inventor's brain. Much useful research work has appeared to fail through lack of opportunity to apply the results. Indeed, it is certain that a great deal of what today is hailed as invention has already been thought of in the past, in part if not in whole, lacking only some further knowledge to achieve fame.

Of recent years the science of helio-therapy has been much in the eyes of the public and it is only a short time ago

that it was realized that ordinary window glass effectively absorbs the curative ultra-violet rays of sunlight. Had this knowledge been available as long ago as 1867, no doubt Mr. T. Eaffield as a result of his researches into "The Action of Sunlight on Glass"[1] would have become the inventor of "Vitaglass," the original ultraviolet transmitting window glass, in place of Lamplough sixty years later.

It is interesting to study Mr. Eaffield's paper in the light of present day knowledge. The writer's aim was primarily to study the action of sunlight on glass, but two of his conclusions are of particular interest to us today. One of his primary objects was to discover which of the glasses then available was most satisfactory for transmitting actinic rays. His method of procedure was to take samples of "easily changing" glass placing them underneath the samples to be tested and noting from time to time, the comparative depth of color to which the underpieces had changed. He found that a "colorless white glass—will transmit all the rays and among them, the actinic or blue ones. In proportion as any kind changes to a yellow or rose, it will lose its power of transmission, and its value as photographic glass." As to cause of variations between various glasses from various makers he states, "It is not the place where any glass is made which determines its good character, but the actual constituent materials and the superiority of its manufacture. . . . The chief point for photographers is to get glass made from as pure material as possible."

Later the writer discusses theories from the facts disclosed. "Some attribute them to the presence of oxyd of iron, and some to oxyd of manganese." . . . In almost all kinds of window glass, materials are used which are not perfectly and chemically pure. The sand, the carbonate or sulphate of soda, and the lime, contain slight impurities of iron, the protoxyd of which gives the glass a green color." He then goes on to show the effect of manganese, which "converts the protoxyd into peroxyd of iron." Later, the author states, "photographers have long noticed that they could take better pictures under a newly glazed skylight, than under one which has been long exposed to sunlight. . . My experiments proved which glasses were best for photographers' use. Most pure glasses, and when I say *pure* glasses, I mean those free from oxyd of iron or manganese, cause nearly all the changes which I have observed."

And, quoting Mr. J. W. Osborn of New York, "It takes but a very slight tinge of yellow to cut off twenty-five per cent of the actinic rays."

So much for our investigator's researches into permeability of glasses to ultra-violet light, and now to turn to another aspect of his work, namely, the decolorization of glasses which have become colored after exposure to sunlight. Quoting Pelouze[2] he says, "Exposure to red heat decolorizes the glasses which have been made yellow by sunlight, or to speak more exactly, they retake the light green shade which they had before exposure. These phenomena can be reproduced indefinitely. The glass preserves its transparency and does not give place to any striae or bubbles. I possess specimens of glass rendered violet by sunlight. All present the property of being decolorized by heat. A temperature of 350 degrees is not sufficient." Pelouze attributed the yellow coloration to the action of sunlight on the protoxyd of iron and sulphate of soda present in the glass, causing a reaction, from which results peroxyd of iron and sulphid of soda. "Heat," he says, "brings about an inverse reaction and reproduces sulphate of soda and protoxyd of iron. From thence comes the return of the glass to its primitive color."

Eaffield and his contemporaries do not appear to have developed the results of their investigations to any practical purpose, but, as we have said before, their work has had to await discoveries in other spheres of knowledge to demonstrate its usefulness.

[1] Amer. Journal of Science and Arts, Vol. 44, No. 132, page 316 (1867).
[2] Comptes Rendus, Jan. 14, 1867.

Vitaglass Now Being Made in the U. S. A. by Automatic Machines

Announcement has just been made of the successful manufacture in this country of Vitaglass by a completely automatic process. Heretofore, this glass was imported from England, where it was made by processes requiring a great deal of hand labor. The new process is a modification of the Fourcault vertical drawing system and permits drawing large continuous sheets. In spite of the fact that some of the materials have to be imported from England, the economies of mass production are stated to have permitted a decided reduction from the prices of the glass of a year ago.

For some time the Vitaglass Corporation has been conducting investigations leading toward automatic manufacture of this ultraviolet transmitting product. It was soon realized that some modification of the ordinary Fourcault process would be necessary due to the peculiar treatment that the glass must receive during and before annealing. Last November, after considerable research and experimentation, construction of a large continuous tank was commenced at the plant of the Flat Glass Specialty Company at Clarksburg, W. Va. This plant was selected because of the special character of all the products manufactured there such as opal sheet, black glass sheet, colored opal, and so forth.

Although the first attempts to manufacture were made in January of this year, the results were not satisfactory from a production standpoint. The lights produced were comparatively small, but it was demonstrated conclusively that glass of high ultraviolet transparency could be obtained by the new process. Further experimentation brought forth a means whereby the sizes of the lights could be increased, and by March the furnace production was stepped up to full capacity, turning out lights in some cases as large as 54 inches by 80 inches. Since then the furnace has been running continuously and producing an excellent quality of Vitaglass.

The new process was developed by the engineering staff of the Flat Glass Specialty Company and the technical staff of the Vitaglass Corporation with the assistance of Chance Bros. & Co., Ltd., of England. Operation of the plant is under co-operative management of the Flat Glass Specialty Company and the Vitaglass Manufacturing Com-

pany. This latter firm is a newly formed subsidiary of the Vitaglass Corporation, and concerns itself primarily with manufacture while the parent company handles the sales of the product. D. M. Bailey, vice-president of the Flat Glass Specialty Company, exercises general supervision of affairs for his firm while the factory manager is J. Gavin Callinan, an engineer with thorough experience in the Fourcault process. Technical control for the Vitaglass Manufacturing Company is in the hands of Donald E. Sharp and H. D. Salisbury. P. H. Jennings is president and general manager of the two Vitaglass companies.

Announcement of the success of the new process was withheld for several months until experts of the Vitaglass Corporation and Chance Bros. & Co. of England could make tests of the product from every standpoint. The results of these tests showed conclusively that the process could be relied upon to produce a uniform product of high quality. In making the announcement one of the officials of the company stated, "Up to the present attempts to make ultraviolet transmitting glass in this country by automatic means have resulted only in the production of glasses which in customary thickness had an ultraviolet transmission of only two or three per cent for the ultraviolet wave-length known as 302 millimicrons. The new process produces a glass that will transmit permanently through the standard thickness of about eight one-hundredths of an inch, more than 50 per cent of the ultraviolet light it receives from the sun, according to tests made by Prof. D. C. Stockbarger."

Glass made by the new process was stated to be slightly stronger even than the earlier products. Nevertheless, it cuts easily with the steel wheel cutter or a diamond, and in this respect cannot be distinguished from ordinary glass. This point was stressed as being important, because it makes the glass a commercially practical one for the jobber.

Recent Patents

NEW INVENTIONS DESIGNED TO IMPROVE GLASS AND THE MEANS OF PRODUCING IT

Complete copies of U. S. Patent Specifications may be obtained from the Commissioner of Patents, Washington, D. C., Price 10c each

APPARATUS FOR FEEDING MOLTEN GLASS. 1,816,463. July 28, 1931. William T. Barker, Jr., Hartford, Conn., assignor to Hartford-Empire Company, Hartford, Conn., a corporation of Delaware. Filed July 14, 1925.

APPARATUS FOR MAKING GLASS. 1,815,977. July 28, 1931. Harry F. Hitner, Oakmont, Pa., assignor to Pittsburgh Plate Glass Company, a corporation of Pennsylvania. Filed May 23, 1927.

APPARATUS FOR MAKING PLATE GLASS. 1,815,972. July 28, 1931. Frederick Gelstharp, Tarentum, Pa., assignor to Pittsburgh Plate Glass Company, a corporation of Pennsylvania. Filed Jan. 17, 1928.

APPARATUS FOR PRODUCING SHEET GLASS. 1,816,180. July 28, 1931. John L. Drake, Toledo, and Luke C. Mambourg, Lancaster, Ohio, assignors to Libbey-Owens-Ford Glass Company, Toledo, Ohio, a corporation of Ohio. Original application filed Aug. 20, 1927, Serial No. 214,278. Divided and this application filed May 2, 1930.

BUBBLED COLORED GLASS ARTICLES. 1,816,045. July 28, 1931. Reuben Haley, Beaver, Pa. Filed Oct. 7, 1927.

FITTER OR SHAPER FOR GLASS ARTICLES. 1,816,280. July 28, 1931. Haller H. Dawson and Ira H. Freese, Clarksburg W. Va.; Lula P. Dawson, executrix of said Haller H. Dawson, deceased, assignors to Hazel-Atlas Glass Company, Wheeling, W. Va., a corporation of West Virginia. Filed Apr. 8, 1926.

SHEET GLASS DRAWING APPARATUS, 1,816,040. July 28, 1931. Joseph P. Crowley, Toledo, Ohio, assignor to Libbey-Owens-Ford Glass Company, Toledo, Ohio, a corporation of Ohio. Filed May 31, 1928.

SHEET GLASS DRAWING APPARATUS. 1,816,036. July 28, 1931. James T. Zellers, Shreveport, La., assignor to Libbey-Owens-Ford Glass Company, Toledo, Ohio, a corporation of Ohio. Filed June 11, 1928.

PROCESS FOR DRAWING SHEET GLASS. 1,816,179. July 28, 1931. John L. Drake, Toledo, Ohio, assignor to Libbey-Owens-Ford Glass Company, Toledo, Ohio, a corporation of Ohio. Filed Aug. 2, 1926.

INSTALLATION OF CORRUGATED GLASS. 1,816,439. July 28, 1931. Paul G. Masters, Philadelphia, Pa., assignor to Pennsylvania Wire Glass Company, Philadelphia, Pa., a corporation of New Jersey. Filed Aug. 1, 1930.

GLASS MELTING-PREHEATER AND MIXER. 1,815,890. July 28, 1931. George Glen Brockway, Warren, Pa., assignor to Nichols Copper Company, New York, N. Y., a corporation of New York. Filed Jan. 4, 1929.

PROCESS OF MAKING CURVED COMPOSITE GLASS PLATES. 1,815,592. July 28, 1931. James H. Sherts, Brackenridge, and John Willits, Ford City, Pa., assignors to Duplate Corporation, a corporation of Delaware. Filed Apr. 24, 1930.

PROCESS AND MACHINE FOR ROLLING RAW PLATE GLASS. 1,816,374. July 28, 1931. Ernst Hilgers, Dusseldorf-Oberkassel, Germany, assignor, by mesne assignments to the American Bicheroux Company, a corporation of Delaware. Filed June 7, 1930.

GLASS. U. S. 1,776,562. Sept. 23, 1930. Bernard Long, Paris, France, assignor to Societe Anonyme des Manufactures des Glaces et Produits Chimiques de Saint-Gobain, Chauny et Cirey, Paris, France. Original application filed 1/12/26, and in France 1/10/27. Divided and this application filed 10/13/27. Cheaper grades of glass such as used for sheet glass, vault lights, etc., are generally made of what are known as lime soda glasses. It has been frequently observed that these glasses, although colorless when first made, become pink or yellow when subjected to sunlight. The inventor has discovered that this change of tint in glasses of this type is due to the action of shorter wave lengths contained in the sunlight in causing new combinations of oxygen in the glass with metallic bases found therein, such as iron, manganese and selenium, and has discovered that this can be avoided by incorporating in the glass small quantities of ingredients tending to absorb the oxygen liberated by such short wave lengths without causing coloration. He proposes to incorporate in a glass of the character described a small quantity of a metallic oxide having the property of absorbing oxygen without the formation of a glass coloring oxide.

He claims a soda-lime glass having a metallic element therein which is affected by waves of short length and containing not over 2% of titanium oxide, the said oxide being present in a quantity sufficient to absorb oxygen liberated in the glass and tending to cause discoloration.

SHEET GLASS SURFACING APPARATUS. U. S. 1,811,044. June 23, 1931. John L. Drake, Toledo, O., assignor to Libbey-Owens-Ford Glass Company, Toledo, O. Filed 2/18/27.

SHEET GLASS APPARATUS. U. S. 1,810,927. June 23, 1931. Ingvald O. Pedersen, Pittsburgh, Pa., assignor to Libbey-Owens-Ford Glass Company, Toledo, O. Filed 10/29/26.

APPARATUS FOR ANNEALING GLASS. U. S. 1,793,199. Feb. 17, 1931. Harold A. Wadman, Hartford, Conn., assignor to Hartford-Empire Company, Hartford, Conn. Filed 3/21/29.

APPARATUS FOR USE IN THE MANUFACTURE OF LAMINATED GLASS. U. S. 1,810,934. June 23, 1931. George B. Watkins, Toledo, O., assignor to Libbey-Owens-Ford Glass Company, Toledo, O. Filed 12/7/28. Including a frame for receiving the assembled sheets therein, and means carried by the frame and adapted to engage the edges of said sheets.

METHOD AND APPARATUS FOR SHAPING GLASS. U. S. 1,811,075. June 23, 1931. Robert W. Canfield, West Hartford, Conn., assignor to Hartford-Empire Company, Hartford, Conn. Filed 1/26/29. A mold, a suction head coacting with the said mold, means therein for withdrawing air from the mold through a plurality of openings and means for substantially instantaneously varying the total size of the openings in response to variations in the level of the glass within the mold.

METHOD AND APPARATUS FOR FORMING SHEET GLASS. U. S. 1,810,980. June 23, 1931. William E. Nobbe, Toledo, O., assignor to Libbey-Owens-Ford Glass Company, Toledo, O. Filed 1/28/28. Consists in drawing a plurality of streams of molten glass upwardly from a molten bath, uniting said streams at their upper ends and while they are still in a substantially vertical position to form a single sheet, and in continuously forcing glass upwardly into the stream sources under hydrostatic pressure.

APPARATUS FOR PRODUCING SHEET GLASS. U. S. 1,812,599. June 30, 1931. Luke C. Mambourg, Lancaster, O., assignor to Libbey-Owens-Ford Glass Company, Toledo, O. Filed 9/6/27.

PRODUCTION OF GLASS IN STRIP FORM AND APPARATUS THEREFOR. U. S. 1,812,537. June 30, 1931. Ernest Bristow Le Mare, St. Helens, England, assignor to Pilkington Brothers Limited, Liverpool, England. Process of gradually reducing the speed of a hot glass strip traveling on a roller-bed by turning some of the rollers supporting the strip in a forward direction and others in a backward direction.

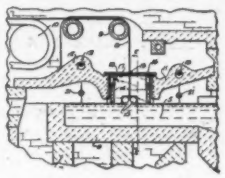
MACHINE FOR CUTTING DESIGNS IN GLASS. U. S. 1,812,485. June 30, 1931. Parker H. James and Harry C. Woodsmall, Indianapolis, Ind. Filed 7/15/29.

PROCESS OF PRODUCING LAMINATED GLASS. U. S. 1,805,259. May 12, 1931. James W. H. Randall, New York, N. Y., assignor to Libbey-Owens-Ford Glass Company, Toledo, O. Filed 2/24/28. The process of producing laminated glass consisting in arranging a sheet of non-brittle material on a sheet of glass, mounting sealing material strips on said sheet of glass and around the non-brittle sheet and in the same plane therewith, then placing a second sheet of glass thereover and combining the whole into a composite structure.

APPARATUS FOR DRAWING SHEET GLASS. U. S. 1,811,125. June 23, 1931. Howard L. Halbach, Clarksburg, W. Va., assignor to Pittsburgh Plate Glass Company. Filed 4/4/28. A hollow metal cooler extending transversely of the bath adjacent such bath and the glass sheet and having a pair of opposing vertical faces with the face next to the face of the sheet substantially parallel thereto, and provided opposite the marginal portions of the sheet with enlargements whose faces also lie parallel to the sheet and closer to the sheet than does the face of the cooler intermediate the enlargments.

MIRROR MITERING MACHINE. U. S. 1,812,415. June 30, 1931. George Simonel, Bloomington, and William H. Johnson, Terre Haute, Ind., assignors to The Nurre Mirror Plate Company, Bloomington, Ind. Filed 4/2/25. The combination with a stationary support for the glass plate to be grooved, of a carriage arranged to be moved in an irregular path over the surface of said plate, a templet for guiding said carriage in said path, a grinding wheel shaft carried by said carriage, a grinding wheel mounted on said shaft, and means for maintaining said grinding wheel shaft in fixed angular relation to the vertical walls of said templet.

SHEET-GLASS-DRAWING APPARATUS. U. S. 1,793,784. Feb. 24, 1931. John L. Drake, Toledo, O., assignor to Libbey-Owens-Ford Glass Company, Toledo, O. Filed 10/8/26. In sheet glass apparatus, a receptacle containing a mass of molten glass, means for drawing a sheet therefrom, heat-absorbing shields arranged above the molten glass, and means for forming a closed compartment between said shields, said sheet being formed in the closed compartment.



GLASS MELTING FURNACE AND PROCESS FOR PRODUCING MOLTEN GLASS. U. S. 1,810,911. June 23, 1931. Enoch T. Ferngren, Toledo, O., assignor to Libbey-Owens-Ford Glass Company, Toledo, O. Filed 3/1/26. In a tank furnace containing molten glass, a rotatable member, means for cooling said member, means for raising and lowering the member relative to the molten glass, means preventing the member from drifting longitudinally of the furnace, means for rotating the member to impart a backward flow movement upon the surface of said molten glass, the surface of said member being so shaped to cause the backward moving surface glass to creep towards the side walls of said furnace, and means for removing the backward moving glass from said tank furnace.

SHEET GLASS FLOWING APPARATUS. U. S. 1,810,921. June 23, 1931. Leopold Mambourg, Lancaster, O., assignor to Libbey-Owens-Ford Glass Company, Toledo, O. Filed 8/26/26. A table arranged in a lower horizontal plane than the outlet end of the furnace and adapted to receive the molten glass therefrom, said table having an overflow lip at one end, a trough arranged below the overflow lip of said table and adapted to receive the molten glass therefrom, said trough comprising a plurality of closely associated pipes constituting the side walls thereof, means for circulating a temperature control medium through said pipes, means for maintaining the glass at a constantly high temperature from the furnace to the trough, said glass flowing from the trough in stream form, and means for absorbing heat from the stream as it leaves the trough to form a sheet.

METHOD AND APPARATUS FOR FEEDING MOLTEN GLASS. U. S. 1,813,742. July 7, 1931. Adrian S. Jones, Redwood City, Cal. Filed 1/20/30. Glass feeding apparatus comprising a receptacle for molten glass having a discharge opening in its bottom, a vertical plunger mounted for vertical reciprocation above said opening, means for lifting said plunger and then permitting the plunger to fall toward said opening independently of said lifting means, and means independent of the glass and of said lifting means for varying the speed at which said plunger will fall toward said opening.

GLASS MELTING APPARATUS. U. S. 1,812,975. July 7, 1931. William A. Morton, Pittsburgh, Pa. Filed 9/15/28. Glass melting apparatus comprising a hearth shaped to accelerate the glass flow, and burners arranged to produce a flame stream flowing in the reverse direction to the glass flow.

TREATING GLASS ARTICLES. U. S. 1,807,017. May 26, 1931. Rowland D. Smith, Corning, N. Y., assignor to Corning Glass Works, Corning, N. Y. Filed 3/5/29. It is well known that the surface of certain glasses which has been frosted is subject to "weathering", which causes a mechanical weakening when the article is subjected to rapid heating.

The inventor has discovered that the injurious effects of certain salts naturally present in the wash water may be completely overcome by the addition of other salts, and is not only able to neutralize the undesirable effects of the natural salt, but can so control the composition as to produce a beneficial effect.

He claims: The method of treating glass articles which includes washing them in water containing simple aluminum fluoride, and the method of treating glass articles which includes washing them in water containing not more than 750 parts per million of simple aluminum fluoride.

The Glass World and What It Is Doing

News of the Industry

July Meeting at Atlantic City

At the meeting of the American Glass Manufacturers Inc., at the Marlborough-Blenheim Hotel, Atlantic City on July 13 George Dougherty, of Morgantown, W. Va., was elected president; S. W. Fisher of Paden City, W. Va., was elected second vice-president; E. P. Ebberts, Monaca, Pa., Treasurer; C. B. Roe of Moundsville, W. Va., and C. M. Rodefer, Bellaire, O., were elected directors. William T. Gillender, president of Gillender Bros. Inc., Port Jervis, N. Y. was elected 1st vice-president, but never learned the fact, having met with a fatal accident, as reported elsewhere as he neared Atlantic City to attend the meeting.

Addressing the members Mr. Dougherty, referring to the past year's business, said the usual trouble was experienced with a small percentage of customers who ignore terms. He also spoke of the evils of deducting cash discount after bills are due on a net basis. He continued as follows:

"During the past year it was proposed by certain Department Store groups that we increase our prices to a point which would enable us to eliminate our discount for cash in fifteen days from date of invoice and establish a discount of 5% on the 10th of the month following that in which charges were made. This proposal was made originally in a business-like manner by the spokesman for one group who explained their side of the case and expressed willingness to co-operate in an effort to familiarize all parties with the merits of their proposal and the mutual benefits it was believed would result if adopted.

"Unfortunately, two other groups in the retail field evidently considered a tactful and considerate approach a waste of time and they served notice on a majority of the manufacturers that they had adopted the proposed terms of settlement and their orders would go only to manufacturers accepting terms they laid down. This policy of intimidation developed the usual result, with our organization acting negatively after due consideration was given the proposal.

"One year ago in Toronto, Ontario, in referring to conditions as they had prevailed in our business for the first six months of the calendar year, I remarked that we had fared quite well as compared to the slump that had taken place in other lines of manufacturing. However, I added that the future might hold a different story for us with the worst yet to come—and it came. I will not dwell on that subject for we hear too much of it on all sides at this time. I will not attempt prophecy because too many prophets have already been discredited in their attempts to foretell how, when and where we will emerge from our distress. It should be encouraging to those of us answering the roll call today that we are still in the game and, having traveled this far, we may reasonably expect to stay until the long, looked-for turn comes."

June Construction Record

June added $331,879,700 to construction contracts awards for the 37 states east of the Rockies bringing the sum total for the first half of the year up to $1,808,226,800. F. W. Dodge Corporation in announcing figures for June and for the half-year period indicates that residential building fared best among the three major construction classes in both the second quarter and the first half of the current year. For the first half of the year the loss in residential contracts was 15 per cent when contrasted with the corresponding period of 1930.

June Production of Polished Plate Glass

The production of polished plate glass in the United States for the month of June, 1931, as compiled by P. A. Hughes, secretary of the Plate Glass Manufacturers of America, was 7,554,219 sq. ft., as compared to 9,465,658 sq. ft. produced in the preceding month. May, 1931, and 9,128,216 sq. ft. produced in the corresponding month last year, June, 1930.

This makes a total of 53,988,661 sq. ft. for the first six months of 1931, as compared to 63,367,375 sq. ft. produced in the first six months of 1930, and 42,456,699 sq. ft. produced in the last half of that year.

Summer Meeting of Glass Division

Announcement was made in July by the Glass Division Committee, L. C. Roche, chairman, A. N. Finn and A. K. Lyle, Jr., that the Summer Meeting of the Glass Division is to be held at Old Point Comfort, Virginia. The program is to leave Baltimore 6:30 P. M. Friday, September 11, from Pier 10, Light St., by Old Bay Line Boat. Dinner on boat. Arrive at Old Point Comfort, Va., Saturday morning. Stay at Chamberlain Hotel Saturday and Sunday (American Plan). Leave Old Point by boat Sunday night. Dinner on boat. Breakfast Monday on boat, arriving in Baltimore 7:30 A. M. September 14.

The members will have the use of the boat's dining room after 8:30 P. M. for informal meetings or business purposes. On Saturday night dinner will be served at the Hotel in a private dining room after which a business meeting may be held. Plenty of bathing, fishing, golf, etc. are promised. The ladies are invited and will enjoy the delightful boat ride down the Chesapeake Bay.

Expenses will include round trip transportation and outside state rooms, two persons to a room, dinner on going trip, dinner and breakfast on return trip. More expensive room may be obtained if desired.

The total cost of the stay at Hotel Chamberlain at Old Point Comfort from Saturday morning to Sunday night (American Plan) two persons to a room, all meals included will be $18.95.

The Hampton Roads Golf Course will be available at usual greens fee.

O'Neill Effects Settlement with Hartford-Empire

Announcement was made on July 27 by Frank O'Neill, president of The O'Neill Machine Company, that there has been a settlement made between the Hartford-Empire Company and themselves in the two cases in which they were involved, and this matter has been withdrawn from the Courts.

These cases involved patent No. 1,212,189 of Cox, on the suit of the Hartford-Empire Company against Carr-Lowrey Glass Company, on the furnace forehearth, as well as the suit involving patent No. 1,521,375 Kinker, of the O'Neill Machine Company vs. Hartford-Empire Company, on their takeoff and stacker.

Giant X-Ray Tube

An award of $1,000 by the American Association for the Advancement of Science for the outstanding paper read at its annual convention was made to Doctors M. A. Tuve, L. R. Hopstead and O. Dahl, the authors of a paper entitled "Experiments with High Voltage Tube." The new type offers possibilities as a substitute for radium in the treatment of cancer, which is affected by the gamma rays. The ray-force it develops is equivalent to that of $182,000,000 worth of that element. By means of another 5,000,000 voltage tube, which the authors are developing, the third radium ray, the alpha ray will be produced and it is expected that the physicists may be able to shatter atoms. The uses of glass in scientific investigation are constantly being extended.

The experimenters first built a gigantic transformer capable of producing 5,000,000 volts. After much experimenting they succeeded in designing a tube of Pyrex glass which could stand the high voltage. Four laboratories including the General Electric Company at Schenectady, the California Institute of Technology, the Carnegie Institution at Washington and a laboratory in Berlin have been in a friendly race to create new vacuum tubes which would withstand the millions of volts necessary to operate such tubes.

William T. Gillinder in Fatal Accident

William T. Gillinder, President of Gillinder Bros., Inc., closed an active career on Monday morning, July 13, when he was drowned in the inlet near Atlantic City. He was on his way to attend a Glass Manufacturers Convention of that city. To avoid hitting a car in front of him he swerved his car aside and went through a fence into water about twenty feet deep. Persons nearby rescued him from the water, and police tried resuscitation methods with pulmotors, etc., to no avail.

William Thynne Gillinder, son of James Gillinder and Martha Bennett, was born in Philadelphia, March 7, 1868. He was educated in the Philadelphia High School and became associated with Gillinder & Sons, glass manufacturers of Philadelphia.

In 1891 he married Sallie Knight, of Philadelphia, who survives him.

In 1912 he went to Port Jervis and with his brothers founded the firm of Gillinder Brothers, manufacturers of glassware, of which he was president. Since that time he has been active in his business interests as well as in the general welfare of Port Jervis.

He was a member of Drew M. E. Church, the Masonic Fraternity, past president of the Port Jervis Rotary Club, vice president of the Co-operative Loan & Savings Society, director of the National Bank & Trust Co., director of the Port Jervis Hotel Corp., President of the Board of Trustees of Drew M. E. Church, treasurer of the Foskett Company and vice president of the American Glassware Manufacturers.

He leaves, besides his wife, Sallie Knight Gillinder, three sisters, Mrs. C. Wm. Masland, Miss Elizabeth Gillinder and Mrs. John T. Carson, all of Philadelphia, and two brothers, Frederick R., of Philadelphia and James, of Port Jervis.

Alexander Kerr

Alexander T. W. Kerr, president of the Kerr Glass Manufacturing Co., of Sand Springs, a Tulsa suburb, died May 14 as the result of a paralytic stroke. Mr. Kerr, who was 42 years of age, was born in San Francisco, the son of Alexander and Amanda Kerr. A year after his birth his parents moved to Portland, Ore., and he received his education at Portland Academy and Harvard University. His father founded the Kerr Glass Co., which in time became the second largest manufacturer of glass jars in the United States.

The Kerr Glass Mfg. Company of Sand Springs, Okla., manufacturers of glass jars, is running to capacity with a force of 200 men working in three shifts. Anticipated bumper crops assure the firm of a good year, according to a company official. The firm is the second largest manufacturer of glass jars in the United States.

The Roessler & Hasslacher Chemical Company, Inc. are doubtless indirectly doing Ex-Governor Al Smith a good turn by moving their main sales office from 10 East 40th Street to the Empire State Building, 350 Fifth Avenue, New York, with the construction of which the Ex-Governor of the State has been prominently identified.

The Owens Illinois Glass Company recently elected H. F. Atherton, secretary of the Allied Chemical & Dye Corporation, New York, a director in the company, succeeding Francis H. McAdoo, New York.

Directory of Consulting Laboratories

Bulletin No. 81 of the National Research Council of the National Academy of Sciences, Washington, D. C., contains a list of industrial laboratories of the United States including consulting research laboratories. This is the fourth edition which was compiled by Clarence J. West and Callie Hull. The first 200 pages of this book are devoted to a list of laboratories including their addresses, the names of those on the research staffs, and the statement of the kind of research work done. This is followed by a list giving the names and addresses of directors of research, occupying 42 pages. The third list shows the geographical distribution of laboratories by states and cities. Subject classification of laboratory activities complete the volume.

Some of the fields covered that have more or less relation to glass manufacturing are as follows:

Forty-four industrial laboratories working in glass, 3 in laminated glass, 27 in celluloid, 63 in cellulose, esters and ethers, 50 in abrasives, 2 on barium products, 118 in ceramics, 76 in chemical engineering equipment, 100 in chemicals, fine, including solvents, 75 in chemicals heavy, 141 in consulting research laboratories, 61 in electric furnaces, 91 in enamel, 86 in fuel utilization, 117 in fuels, 56 in heat, 8 in heat transfer, 67 in heating, 36 in illuminatipn, 50 in insulation, thermal; 3 in neon and neon lamps, 135 in petroleum and its products, 108 in plastics, 4 in pyrometry, 83 in refractories, 17 in resins, 3 in solvent recovery, 5 in titanium of compounds, 4 in tungsten, 11 in vacuum tubes, 3 in vanadium, 63 in water softeners, 1 in X-ray crystal analysis, 5 in X-rays, 3 in zeolites, 2 in zirconium.

Coming Meetings

The Eastern Division, National Glass Distributors Association, will meet at Atlantic City September 24 and 25.

The Illuminating Engineers Society's 25th annual convention (celebrating its silver anniversary), Pittsburgh, Pa., October 13-16 inclusive, headquarters, William Penn Hotel.

American Bottlers of Carbonated Beverages, as announced by National Secretary, Junior Owens, Washington, D. C., will hold their annual convention and exposition at Dallas, Texas, Nov. 9-12.

Inquiries Received

For further information address THE GLASS INDUSTRY.

556. (From Belgium.) We should like to obtain the names of firms building automatic machines for making pressed tumblers, etc., working in connection with a continuous tank, and also semi-automatic machines used in connection with the ordinary pots.

557. I should like to obtain the names of manufacturers of glass picture frames (photos) and mirrors.

558. Please tell me what glass sand deposits are available in Central and South American countries.

What the World Wants

Specific Inquiries for American Goods Received in the Department of Commerce, Washington, D. C. For further information write the department.

Panama—52921. Glasses and beer bottles.
Spain—52892. Glassware.
Italy—52775. Glass articles, pressed.
Portugal—52786. Glass plate, safety, shatter proof.
Brazil—52839. Glass tubes for tablets.
Costa Rica—52774. Glassware for pharmaceutical products and toilet preparations.
Canada—52780. Glassware, hotel, restaurant and cafe.
Colombia—52831. Glassware, table.
Hong Kong—52603. Glass, broken, white, unwashed, 500 tons.
Dominican Republic—52407. Bricks, refractory and fire clay.
India—52470. Clay, china.
Panama—52450. Glass tumblers, and chinaware, low priced.

Readers Wants and Offers

Address answers to all "keyed" ads c/o The GLASS INDUSTRY 24 West 40th St., New York

WANTED—AT ONCE—

MANAGER of hand blown operation making a diversified line of ware in colors.

Applicant must be between thirty-five and forty years of age, and it is preferable that he have had some sales experience or contacts.

Please state education, experience and references.

Address—Class AU-1, care THE GLASS INDUSTRY, 24 West 40th Street, New York.

Current Prices of Glass-Making Materials

May 21, 1931

Quotations furnished by various producers, manufacturers and dealers

Acid	Carlots	Less Carlots
Citric (dom.) lb.	.35	.35
Hydrochloric (HCl) 20° tanks, per 100 lb	..	1.10
Hydrofluoric (HF) 60% (lead carboy) lb.	..	.13½
52% and 48% lb.	.10	.10-.11½
Nitric (HNO_3) 38° carboy ext. Per 100 lb.	5.50	..
Sulphuric (H_2SO_4) 66° tank cars ton	5.50	..
Tartaric lb.	..	.31½
Alcohol, denatured gal.	..	..
Aluminum hydrate ($Al(OH)_3$) lb.	.04½-.05	.05½-.06
Aluminum oxide (Al_2O_3) lb.	..	.07
Ammonium bifluoride (NH_4) FHF lb.	..	.15½
Ammonia water (NH_4OH) 26° drums lb.	.02½	.02¾
Antimony, metallic (Sb) lb.	..	.09½
Antimony oxide (Sb_2O_3) lb.	..	.08½
Antimony sulphide (Sb_2S_3) lb.	..	.14
Arsenic trioxide (As_2O_3) (dense white) 99% lb.	.04	.04½
Barium carbonate ($BaCO_3$), Crude. (Witherite) 90%, 99% through 200 mesh ton	47.00	..
90% through 100 mesh ton	44.00	..
Barium hydrate ($Ba(OH)_2$) lb.	..	.05¼
Barium mixture, glassmaker's, f.o.b. St. Louis ton	25.00	..
Barium nitrate ($Ba(NO_3)_2$) lb.	..	.07¼
Barium selenite ($BaSeO_3$) lb.	..	..
Barium sulphate, in bags ton	19.00	24.00
Barium sulphate, glassmaker's, carlots, bulk, f.o.b. shipping point, ton	15.00-16.00	18.00
Bone ash carlots, lb.	.06	.06½
Borax ($Na_2B_4O_7 10H_2O$) lb.	..	.0355-.0425
Crystal lb.	.028-.033	..
Granulated lb.	.025-.03	..
Powdered lb.	.02875-.03375	..
Boric acid (H_3BO_3) lb.	.0625-.07125	.0625-.08125
Refined lb	0625-.07125	.07125-.08125
Cadmium sulphide (CdS)— Red lb	..	.65-.90
Orange lb.	..	.60-1.10
Yellow lb.	..	1.30-1.50
Chromium oxide (Cr_2O_3) lb.	.23	.24
Cobalt oxide (Co_2O_3) In bbls. lb.	..	1.35-1.65
In 10 lb. tins lb.	..	1.45
Copper oxide Red (Cu_2O) lb.	..	.25
Black (CuO) lb.	..	.17-.19
Black prepared lb.	..	.22
Cryolite ($Na_3Al F_6$) Natural Greenland Kryolith) lb.	.09	.09¼
Synthetic (Artificial) lb.	..	.09½
Epsom salts ($MgSO_4$) (imported) Per 100 lb.	..	1.15-1.20
*Feldspar— 100 mesh ton	11.50-17.50	12.00-18.00
80 mesh ton	11.00-11.50	13.00
40 mesh ton	10.75-11.00	12.00
20 mesh ton	9.50- 9.75	10.00
Fluorspar (CaF_2) domestic, ground, 95-98% (max SiO_2, 2½%) Bulk, carloads, f.o.b. mines ton	30.00	..
In bags or barrels ton	34.00	39.00
Imported ton	31.00	33.00-37.00
Formaldehyde lb.	..	.07
Graphite (C) lb.	..	.04-.07
Iron oxide— Red (Fe_2O_3) lb.	..	.0450
Black (FeO) lb.	.04½	..
Kaolin (f.o.b. mine) ton	8.00-9.00	..
English, lump, f.o.b. New York ton	14.50-25.00	24.50-30.00

*Spot Shipments.

Kryolith (see Cryolite)	Carlots	Less Carlots
Lead cnromate ($PbCrO_4$) lb		30
Lead oxide (Pb_3O_4) (red lead) lb	.069	.07¾
Litharge (PbO) lb	.059	.06¾
Lime— Hydrated ($Ca(OH)_2$) (in paper sacks) ton	7.00	7.00
Burnt (CaO) ground, in bulk ton	6.00	..
Burnt, ground, in paper sacks ton	8.00	8.00
Burnt, ground, in 280 lb. bbls. Per bbl.	2.15	..
Limestone ($CaCO_3$)	1.75-2.50	1.75-2.50
Magnesia (MgO)— Calcined, heavy (in bbls.) lb.	.06	.07
light (in bbls.) lb.	..	.23
extra light (in bbls.) lb.	..	.37
Magnesium carbonate ($MgCO_3$) lb.	.06	.10
Manganese 85% (MnO_2) lb.	.03	.03
Nickel oxide (Ni_2O_3), black— for nickel content lb.	..	.35
Nickel monoxide (NiO), green— for nickel content lb	..	.35
Plaster of Paris, bags ton	21.00	23.00-29.00
Potassium bichromate ($K_2Cr_2O_7$)— Crystals lb	.09	.09¼
Ground lb	11	12
Potassium carbonate—94-96% lb.	.0555	.0555
Calcined (K_2CO_3) 96-98% lb.	.06½	.07¼
Hydrated 80-85% lb.	.05¾	.06¼
Potassium chromate (K_2CrO_4) lb.	..	.23-.32
Potassium hydrate (KOH) (caustic potash) lb	.07⅛	.08
Potassium nitrate (KNO_3) (gran.) lb	..	.06½-.06¾
Potassium permanganate ($KMnO_4$) lb	.16	.17
Powdered blue lb.	..	.195
Rochelle salts, bbls. lb.	..	.19
Rouge lb.	..	..
Rutile (TiO_2) powdered, 95% lb	.15-.20	20-.25
Salt cake, glassmakers (Na_2SO_4) ton	22.00	..
Selenium (Se) lb	..	1.80
Silver nitrate (AgNO.) (100 oz.) per oz	..	.22½
Soda ash (Na_2CO_3) dense, 58%— Bulk, on contract Flat per 100 lb	1.07½	..
In barrels Per 100 lb.	1.38	1.90-2.00
In bags Per 100 lb.	1.17½	1.72½
Spot orders .. .025 per 100 lbs. higher	..	..
Sodium bichromate ($Na_2Cr_2O_7$) lb	.07	.07½
Sodium hydrate (NaOH) (caustic soda) Solid Per 100 lb.	2.50	..
Sodium nitrate ($NaNO_3$)— Refined (gran.) in bbls lb	.03⅞	.04½
95 per cent. Per 100 lb	2.01½-2.05	2.06½-2.10
Sodium selenite (Na_2SeO_3) lb	..	2.00
Sodium fluosilicate (Na_2SiF_6) lb.	.04	.04½
Sodium uranate (Na_2UO_4) Yellow or Orange lb.	..	1.50-1.55
Sulphur (S)— Flowers, in bbls. Per 100 lb	3.45	3.80-4.00
Flowers, in bags Per 100 lb	3.10	3.45-3.65
Flour, heavy in bbls. Per 100 lb	2.85	3.20-3.40
Tin chloride ($SnCl_2$) (crystals) lb	.37½	.39
Tin oxide (SnO_2) in bbls. lb.	.28	.29½
Uranium oxide (UO_2) (black, 96% U_3O_8) 100 lb. lots. Black lb.	..	2.75
Yellow lb.	..	1.50
Zinc oxide (ZnO) lb.	.08½	.12
American process, Bags lb.	.06½	.07
Zircon Granular (Milled .005-.02c higher)	07	07½-.08
Crude, Gran. (Milled .005-.02c higher)	.03½	04-.05

Monthly Summary of United States Foreign Commerce in Glass

EXPORTS

Corrected to June 25, 1931.

	May 1930 Quantity	May 1930 Value	May 1931 Quantity	May 1931 Value	Five Months Ending May 1930 Quantity	Five Months Ending May 1930 Value	Five Months Ending May 1931 Quantity	Five Months Ending May 1931 Value
Glass and glass products (Total)	.....	$893,707	.....	$629,203	.....	$4,025,799	.....	$3,434,746
Plate and window glass—								
Window glass, common, box 50 sq. ft.	1,769	12,425	1,092	10,614	8,193	45,954	4,400	27,638
Plate glass, unsilvered, sq. ft.	426,304	125,880	304,214	94,462	1,488,504	465,457	1,988,101	609,139
Other window and plate glass lbs.	442,373	39,350	385,208	36,647	2,260,998	211,445	1,539,525	167,683
Glass containers (bottles, vials and jars)	.....	295,173	.....	176,560	.....	1,239,077	.....	957,250
Table glassware, plain	.....	109,704	.....	84,407	.....	548,767	.....	432,851
Table and other glassware, cut or engraved	.....	7,419	.....	13,173	.....	42,359	.....	39,275
Lamp chimneys and lantern globes lbs.	.....	22,232	.....	7,895	.....	96,406	.....	45,771
Globes and shades for lighting fixtures lbs.	.....	53,206	.....	40,213	.....	272,570	.....	199,819
Chemical glassware lbs.	17,081	19,204	13,669	14,579	95,146	91,493	63,643	64,567
Electrical glassware, except for lighting lbs.	410,080	31,877	108,509	6,480	2,361,840	155,469	608,105	44,006
Other glassware	.....	177,237	.....	144,173	.....	856,802	.....	846,747

IMPORTS

Corrected to June 25, 1931.

Glass and glass products	.....	$837,952	.....	$526,710	.....	$4,017,990	.....	$2,528,616
Cylinder, crown, and sheet— Plain dut. lb.	1,665,821	71,378	498,918	18,461	10,960,357	394,820	3,891,808	152,732
Bent, beveled, colored, etc. dut. lb.	.....	38,629	141,482	22,985	.....	175,289	875,722	117,381
Plate glass dut. sq. ft.	420,533	86,436	572,272	174,768	2,971,543	649,283	2,168,697	650,239
Glass mirrors	.....	.....	105	318	.....	.....	676	1,657
Rolled, cylinder, crown, and sheet glass, ground, obscured, bent, beveled, colored, etc.	.....	.....	.....	10,191	.....	.....	.....	26,860
Laminated glass and manufactures, and plated glass	.....	.....	.....	283	.....	.....	.....	4,082
Bottles, vials, jars, and other containers	.....	109,159	.....	36,410	.....	622,825	.....	215,117
Scientific articles and utensils dut.	.....	57,232	.....	38,237	.....	250,209	.....	161,222
Tubes and rods dut.	.....	.....	.....	6,958	.....	.....	.....	48,210
Illuminating articles dut.	.....	38,943	.....	29,022	.....	285,516	.....	155,895
Blown glass articles— Bulbs for electric lamps, without filament dut.	1,692,768	18,236	1,041,569	10,477	7,160,660	65,194	6,119,558	59,885
Other blown glass articles dut.	.....	330,201	.....	95,645	.....	1,047,757	.....	533,563
Pressed glass articles	.....	11,931	.....	4,901	.....	70,125	.....	50,948
Other glassware	.....	75,807	.....	78,084	.....	456,972	.....	350,825